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THE SOCIAL COST OF ENVIRONMENTAL

POLLUTION Partial Final Report

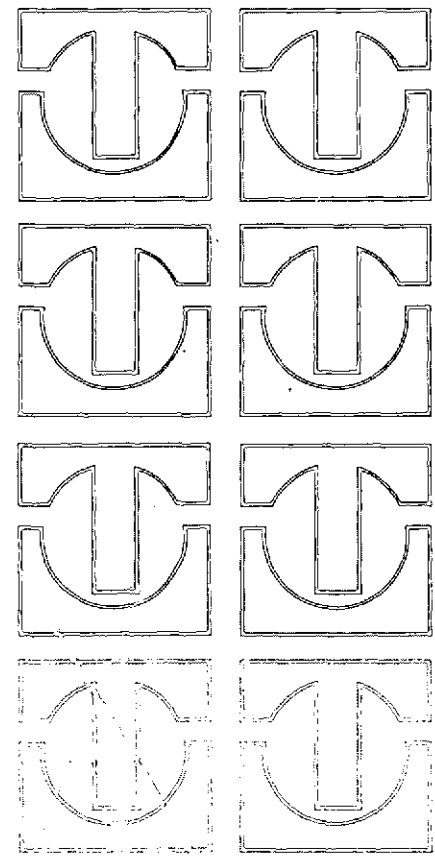
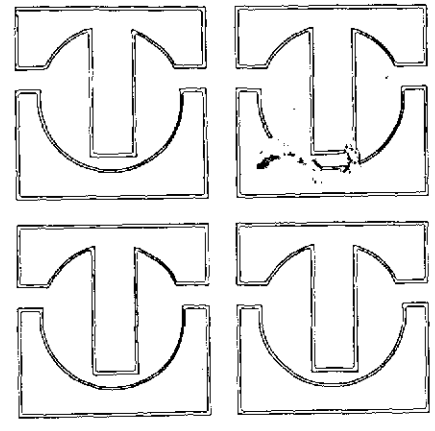
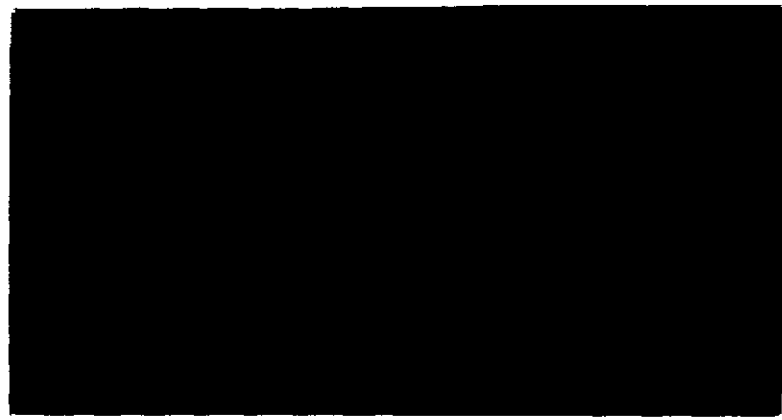
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COLLEGE OF BUSINESS ADMINISTRATION

THE UNIVERSITY OF TENNESSEE

N74-22591

MEASURING AND MINIMIZING THE  
SOCIAL COST OF ENVIRONMENTAL  
POLLUTION

**PRICES SUBJECT TO CHANGE**

Partial Final Report

*NGC-*  
UT/NASA Grant 43-001-021

UT/NASA Sustaining University Program

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## INTRODUCTION

A series of legislative acts in the U.S. Congress and in various states in the last few years has triggered one of the most significant and far-reaching endeavors of the entire twentieth century in the United States. This nationwide effort is to improve the quality of the physical environment in which we live by reducing by several orders of magnitude the rate of pollution of our atmosphere, our water resources, and our land.

In our free enterprise economic system, the role of producing the goods and services needed and demanded by society is assigned primarily to privately-owned business firms. These organizations and a few government-owned entities have produced a large fraction of the total "pollutants" as a result of their productive activities. Individuals, households, municipalities, and other organizations contribute significant amounts also, but the manufacturers and power-producing corporations are viewed by many as the major culprits. Therefore, the thrust of the legislative acts has borne heavily on these producers.

This study was initiated to determine the various impacts of the environmental protection movement on the largest corporations in several industries which had the most serious pollution problems. The purpose was to examine the impacts from the point of view of top corporation managers so that a broader perspective could be provided for all concerned parties--citizens, environmentalists, legislators, governmental administrators and agency personnel, scientists, engineers, and other industrial managers.

## IMPORTANCE OF THE STUDY

In any endeavor where the costs are as great and the consequences as far-reaching as those of the environmental protection effort, it is very important to evaluate progress toward goals objectively in order to minimize undesirable consequences, to utilize resources most efficiently and to maximize worthwhile accomplishments. Also, whenever a multitude of goals are sought simultaneously, a study of the cross-impact of various actions can provide a better perspective for clarifying goals and for developing new action plans. Therefore, an examination of the impacts of environmental protection on corporation plans and actions will provide the basis for evaluating the impact on society at large, since the corporations occupy such a central and vital position in society.

## DESIGN OF THE STUDY

In order to determine most directly the impact of the environmental protection movement on industrial corporations, top executives were contacted in the largest companies in seven industries which were known to have significant pollution problems. These industries, the number of firms contacted in each one, and the number which provided useful information are shown in Table 1. Companies within each industry were selected, with a few exceptions, on the basis of sales volume, as shown in the "Special Report on Corporate Performance" in Business Week, November 13, 1971. The largest companies in each industry were selected because the magnitude and range of the impacts were assumed to be greatest

TABLE 1

NUMBER OF PARTICIPATING COMPANIES AND COMPANIES CONTACTED, BY INDUSTRY

<u>Industry</u>	<u>Number of Firms Contacted</u>	<u>Number of Firms Participating</u>
Automotive (including auto. equipment)	7	3
Chemical	20	12
Electric Utility	19	9
Non-Ferrous Metals	10	5
Paper	12	5
Petroleum	17	11
Steel	10	5
Other	<u>5</u>	<u>4</u>
	100	54

among these firms and because it was assumed that the responses to the problems and the concerns and viewpoints of managers in these firms would be most significant in trying to evaluate the total impact of environmental protection on major industrial segments of society.

The first part of the study consisted of personal interviews with executives or staff specialists in seven companies located in Texas, New York, Kentucky, and Tennessee. Personal contacts were made in order to gain a better understanding of pollution control problems and impact areas in industrial firms and to learn what specific companies were doing to control pollution. A brief interview guide was used which consisted



of questions about company goals; policies on environmental protection and social responsibility; types of pollution problems; pollution control activities, impacts, and major concerns; and the company's planning system. Companies were selected for these initial interviews on the basis of having significant pollution problems and being convenient to the investigator (in terms of location and known contacts). However, all except one of these companies were either within the seven industries under study or were diversified producers of equipment used by these industries. The remaining one, a mining company, produced coal for one industry under study (electric utility) and was a subsidiary of a utility company.

After these initial interviews, a five-page questionnaire was designed and mailed with a personal cover letter to the president\* of each of 94 major private corporations and to the Chairman of the Tennessee Valley Authority, a government-owned corporation which is a large producer of electric power. A copy of the letter is shown in Appendix A and the questionnaire is included as Appendix B. Since questionnaires were sent to the presidents of some of the companies where interviews were held, a net total of 100 companies were contacted. Of these, 54 provided data or viewpoints which were useful in the study, and these firms are listed by name in Appendix C. Representatives of 9 other firms responded and expressed interest in the

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\* The names of company presidents were obtained from Dun & Bradstreet Reference Book of Corporate Managements, 1971-1972 edition.

study, but declined to participate, primarily because of the amount of detailed information requested and because of existing workloads.

The amount of information provided varied quite widely between companies and some did not complete the questionnaire. However, each of the companies included in Appendix C provided company documents or personal viewpoints which were considered significant. The persons who responded and those who were interviewed held various positions in their respective companies, but generally they fell into three categories: (1) top executives--presidents or vice presidents, (2) directors or staff specialists in environmental protection departments, and (3) public relations personnel. Most answers came from the first two groups and generally their answers were more complete and more useful than those provided by the third group. A list of the positions of respondents is included as Appendix D.

#### SURVEY RESULTS--FINDINGS AND ANALYSIS

The results are presented in the order of the topics on the questionnaire. The questions are not restated fully in this section, but subheadings will reflect the general topic under discussion. Appendix B contains the entire set of questions.

##### Policy on "Environmental Protection" (Questions #1 and #19)

When asked if they had a formal (written) policy on "environmental protection", 38 of 49 companies gave an affirmative answer. Only 11 companies said they had no formal policy, but 9 of these reported that an implicit policy existed. Twenty-six of the companies with a formal

policy reported the date their policies were adopted, and only four of this group gave a date earlier than 1967. Twelve firms said their policy was formed in either 1971 or 1970, and ten others formalized their policy in 1969, 1968, or 1967. Thus, the emphasis on environmental protection in the last few years throughout the nation probably motivated many firms to establish a formal policy, not only to guide managerial actions, but to inform all employees, stockholders, and the general public of their beliefs and intentions about pollution control.

Twenty-nine organizations provided copies of their policies on environmental protection and ten of these granted permission to identify the source of the policy (Question #19). Every formal policy submitted and all statements of implicit policies expressed generally strong support for environmental protection measures. However, several policies included some reservation about unlimited pollution control and this was done by emphasizing the need to balance goals or to weigh costs vs. benefits.

A policy may be defined as a statement of the belief and intent of a particular organization on a given topic, issue, or function which serves as a guide for managerial plans and actions. Policies are established by industrial firms and other formal organizations on many different aspects of their operations in an effort to avoid inconsistent actions between managers or organizational units or from one time period to another. Thus, a formal policy on environmental protection in a company is entirely appropriate and can be very useful internally and externally, if carefully written. The policies received from respondents did not appear to be public relations gimmicks or hollow platitudes. However, some were very broad and general, while others were somewhat defensive

and emphasized past accomplishments in protecting the environment. Some contained many precautions about excessive control measures and at least one contained a sermon on proper standard setting. For the most part, they were viewed as sincere attempts on the part of corporation executives to state their beliefs, intentions, concerns and philosophies of management.

Several of the policies submitted are quoted below or reprinted in appendices to illustrate variations between companies in different industries and to show differences in policy styles, formats, and comprehensiveness. One of the largest, most diversified companies in the world issued the following concise policy on "Environmental Protection" in 1971:

It is the policy of the General Electric Company to contribute to environmental protection by eliminating or limiting to lowest practicable levels, and in any event limiting to statutorily defined levels, all adverse environmental effects from its products, facilities and activities, and by offering products and processes which will help solve environmental problems.

A large pulp and paper producer, Crown Zellerbach Corporation, established a formal policy in 1970 on environmental protection which was linked directly to The National Environmental Policy Act and to compliance with laws and regulations. The policy follows:

The Corporation supports the declaration in The National Environmental Policy Act that each person should enjoy a healthful environment and that each person has a responsibility to contribute to the preservation and enhancement of the environment.

Consistent with the national policy and acknowledging that its goals can best be achieved in conformance with this policy, the Corporation recognizes that in the conduct of its business and corporate affairs, it has a continuing responsibility to

contribute to the protection, preservation and enhancement of the environment. In the allocation, commitment, use and development of Corporate resources, an appropriate consideration shall be the fulfillment of the Corporation's environmental responsibilities. All corporate activity shall be evaluated, conducted and reviewed in light of its impact on the environment and to comply with laws and regulations concerned with environmental protection or control.

Another pulp and kraft linerboard producer has made the following "Commitment on Environmental Protection":

Tennessee River Pulp and Paper Company has publicly recognized its responsibility to wisely use the natural resources under its control--particularly air, forest land and water. As a corporate citizen, the company is committed to full compliance with the requirements of government agencies concerned with environmental quality. This means the spirit as well as letter of the regulations.

A comprehensive policy on "Environmental Conservation" has been developed by Shell Oil Company and is reprinted in Appendix E. It includes specific types of action to be undertaken to promote and achieve pollution control. Another major petroleum company developed a policy in 1971 on "Environmental Affairs" which stressed the need for a balanced use of resources to serve multiple purposes and included specific operational objectives. It is reprinted in Appendix F. On December 10, 1969, the President of Ford Motor Company stated publicly the formal policy of his company at a press conference in these words:

Today I am publicly committing Ford Motor Company to an intensified effort to minimize pollution from its products and plants in the shortest possible time. There is, of course, no such thing as a completely "clean" motor vehicle or industrial plant, but we will achieve products and manufacturing facilities that do not significantly contaminate our atmosphere, waters or landscape.

He then outlined ten specific action plans the company would take to carry out its responsibility in the area of pollution control.

The policy of Dow Chemical Company, shown in Appendix G, focused on excellence and leadership in "Environmental Improvement." In contrast, another chemical company had issued a "compliance with sound standards" policy, in which they said the company would:

- a. participate with federal, state, and local agencies responsible for developing new standards in order to arrive at regulations that serve the public interest, that are sound and realistic, and that have sufficient merit to be sustained,
- b. comply with such standards,
- c. oppose standards that are capricious, unrealistic, or that, because of their ineffectiveness, must be frequently changed,
- d. seek the planned, long-term solution rather than the temporary crash expedient ..., and
- e. provide for full compliance in new construction, not only with present standards, but with those that can be anticipated in the next five years.

Another chemical company stated simply that the company "will comply with all state and federal rules and regulations pertaining to air/water/solid waste pollution control." This was the tenor of the policies of several other companies--in short, "obey the law." One interviewee stated this policy as "do it--meet government regulations." Other companies stated this same policy, with reservations. One said "we will meet any federal and state pollution control standards, if technically feasible; another stated that "we expect to abide by the law and to try to be a good environmental citizen, within the limits of economic practicality."

In American Metal Climax, Inc., a policy which had been implicit for many years was formalized in 1971. It is reproduced as Appendix H. In Armco Steel, a policy was formalized in 1966 which expressed the belief "that both legitimate environmental needs and economic feasibility must be taken into account when pollution abatement standards are set." The final, key sentence in the policy stated:

As a corporate citizen, we recognize our responsibility to cooperate fully with private and public agencies in their efforts to protect the nation's water and air resources.

Jones and Laughlin Steel Corporation has a policy on "Air and Water Quality Control" which was "to participate actively in the creation and preservation of acceptable environmental quality in all communities in which the corporation operates." Also, the policy stated that "new facilities are and will be designed to meet or exceed government standards for air and water quality "and that existing facilities are to be brought into compliance with current standards as rapidly as technology and economics permit."

Many utility companies had not formalized a policy on environmental protection and the formal policies reported were generally short statements of general creeds or social objectives. Perhaps in this highly regulated industry, the need for more fully developed policies was not considered urgent. However, in the Tennessee Valley Authority, a policy on "Environmental Quality Management" was formalized in 1971. Excerpts from this policy follow:

TVA recognizes that maintenance of a quality environment is of major importance to the Nation.

Protection and enhancement of environmental quality is an integral part of TVA's concept of unified development of the resources of the region....At the earliest possible stage in planning its activities, TVA considers their environmental impact in a broad, interdisciplinary manner, which includes the natural and social sciences and the environmental design arts....To the fullest extent practicable, TVA assesses potential environmental impacts to avoid or minimize adverse effects and to restore or enhance environmental quality.

In summary, most companies had a formal policy on environmental protection and a large number of these firms had formalized such a policy during the 1967 through 1971 period. Some policies were much longer and more comprehensive than others, and they reflected management philosophies ranging from progressive environmental improvement to reluctant compliance with the law.

Policy on "Social Responsibility" (Question #2)

Only 14 of 38 companies reported that a formal policy on "social responsibility" existed. However, 18 of the other 24 companies said that an implicit policy existed, and only 2 firms stated that no formal or implicit policy existed. Three companies (chemical, petroleum, and industrial equipment) said their policy was formalized in 1971 or 1972. One automobile company formalized such a policy in 1969, and 4 other companies reported policies of longer duration. The Tennessee Valley Authority reported that their basic mission, as established by the TVA Act, was oriented to social responsibility.

The "social responsibility" of a business firm may be defined as the obligation to cooperate in achieving the stability and well-being of society and to treat various groups and individuals which interact with



the firm in a fair manner. Some people think of it merely in terms of company contributions to worthwhile organizations or short-term social service projects. However, the concept is much broader and is being accepted in the broader sense in more and more firms. It is really a philosophy of management which deals with the role of business firms in society and the primary and secondary goals they pursue. (The priority of goals is discussed in the next section.)

The policies on social responsibilities which companies provided were generally broad, creed-type statements about serving society in various ways. The activities pursued in meeting social responsibilities, in addition to fair dealing with employees, customers, stockholders, suppliers, communities, and governmental units, included environmental protection, minority training and employment, educational assistance, contributions to worthy organizations, and many other types of involvement in urban affairs. A few companies are currently developing more comprehensive policy statements which will be meaningful expressions of their beliefs and intent on social responsibility.

Such a statement on "The Social Role of Business" was formulated in Standard Oil Company (New Jersey) in 1971 and distributed to key managers. The company rejected the extreme alternatives of (1) ignoring social needs to concentrate strictly on making profits and (2) becoming a social welfare institution to serve any and all needs of society, with little attention given to profits. Instead, they advocated a middle road--a policy of "enlightened self-interest"--which would include the

pursuit of profitable business activities and a responsiveness to the changing attitudes, values, and interests of others in society. This summary of the company's policy is based on excerpts from their formal internal document which were reprinted by permission in the October, 1971 issue of The Roper Report. A set of guidelines for developing plans and actions from this document are outlined in Appendix I. They are considered to be excellent guides for managers who seek to fulfill their social responsibility.

Social responsiveness and business pursuits are not incompatible, but the type and manner of business endeavor should reflect a responsiveness to social needs and values, so that society as a whole benefits while individual investors, employees, and customers also benefit at the same time. This view was reflected in the policy statement of one respondent, which was "to operate our plants and conduct our business in a manner consistent with the public good." This is the emerging concept of social responsibility which an increasing number of firms are adopting. The precise way to implement such a policy is not clear in most companies, but an increasing amount of attention is being given to this question. Environmental protection is but one aspect of the broader concept of social responsibility.

#### Priorities of General Business Objectives (Questions #3 and #4)

Several broad, general business objectives were listed on the questionnaire and corporations were asked to indicate the priority assigned to each goal and to other unlisted goals. One respondent protested that all listed goals were equally important and that priority

differences were not meaningful. However, 31 participants assigned priorities, even though some gave the same priority to two or more objectives. The results are shown in Table 2.

The responses, not surprisingly, indicated that profit is the first priority in most companies, since 25 firms ranked it first, 5 others ranked it second, and none ranked it lower. The second priority overall was to provide needed goods or services, since 15 ranked this objective first, and 11 others ranked it second or third. The third-ranking objective was to fulfill social responsibilities, since 24 respondents gave it one of the first four priorities. Growth in size and the creation of new or better products through research and development were ranked about equal in importance, since each objective was assigned one of the first four priorities by 19 companies. Survival, surprisingly, was the least important objective in terms of the overall rankings, even though 10 companies included it as either a first-or second-level priority. Other goals listed, including some which were not assigned a ranking, were:

- (a) provide jobs and personal growth opportunities
- (b) (help) people--our employees and community
- (c) (insure) safety and health (to workers)
- (d) provide for energy needs in the future
- (e) maintain a balance of debt and equity capital
- (f) earnings growth
- (g) comply (with laws) on the "environmental kick"

Other operational goals were mentioned, but they fell outside the scope of the question.

TABLE 2  
PRIORITIES OF BUSINESS OBJECTIVES AMONG CORPORATIONS

<u>Objective</u>	<u>Priority #</u>	<u>No. of Companies Assigning Each Priority</u>					
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
Provide Goods, Services		15	7	4	1	1	0
Profit		25	5	0	0	0	0
Survival		6	4	2	1	1	4
Social Responsibilities		7	5	8	4	1	0
Growth		3	5	6	5	4	1
New Products		2	8	4	5	1	3
Other		1	1	1	0	2	0

Note: Some respondents assigned the same priority to two or more objectives.

In summary, companies seemed to be pursuing several objectives simultaneously, and the difference in the overall importance of many of these goals was not great. However, profitability and providing needed goods and services were clearly considered first and second, respectively, in importance.

Ten of thirty respondents indicated (Question #4) that a shift in importance between these objectives had occurred in the past three years, while 20 others said no shift had occurred. One person explained the shift as follows: "Today, maximum financial gain, the historical number one objective, is forced into second place whenever it conflicts with the well-being of society." Another said there was a "continued emphasis on profitability

and more on social responsibility." Others said there was a "growing awareness of social responsibility," "recognition of the changing social climate," "more emphasis on social responsibility."

One company was greatly concerned about survival. A top executive in the non-ferrous metals industry said: "Survival has become an explicit priority. The neglect of basic industry in U.S. policy formulation is appalling." Another top executive in a utility company said that a short-range concern today is how the electric power industry will survive the capital requirements of the next five years."

Thus, several companies reported a shift to more emphasis on fulfilling social responsibilities, but at the same time, many were concerned about the impact of the environmental protection movement on economic performance. These concerns will be discussed more fully under Question 12.

#### Priorities of Pollution Concerns (Question #5)

The companies surveyed were asked to indicate the relative importance of the various types of pollution problems or concerns they had by assigning a rank order to the most common types of pollution. The results are shown in Table 3. Some respondents assigned the same rank to two or more types of pollution.

Thirty-four corporations responded to this question, and every one of them had both air and water pollution concerns. However, air pollution ranked higher than water pollution overall, since 25 organizations gave it first priority or said it shared the top priority in their operations. Water pollution ranked second, with 19 firms assigning it first priority

TABLE 3  
RANKING OF POLLUTION TYPES IN PARTICIPATING COMPANIES

<u>Type of Pollution</u>	<u>Priority #</u>	<u>No. of Companies Assigning Each Priority</u>					
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
Air		25	7	2	0	0	0
Water		19	11	3	0	1	0
Thermal		4	6	4	4	4	0
Noise		2	7	7	7	1	0
Solid Waste		4	5	15	4	1	1
Radioactive Contamination		2	3	1	2	0	1

and 11 others ranking it second. Solid waste pollution was third in overall importance, since all but four respondents checked it as a problem, and 24 ranked it in the top three (fifteen of these companies ranked it third).

Noise pollution received a surprising number of votes, with 24 companies indicating it was a problem. Thermal pollution was about the same as noise pollution in overall importance, with 22 evenly-distributed votes. Radioactive contamination was ranked last, being of concern to only 9 companies. Another type of concern, "light pollution," was listed by a major petroleum company, and they ranked it more important than radioactive contamination. This type of pollution arises from burning waste products or surplus gas.

In summary, the results indicated that most companies had several types of pollution concerns, with air and water pollution the most serious.

Pollution Control Impacts on Facilities (Question #6A)

One of the major impacts of the environmental protection movement has been a sizeable capital investment program in almost every industrial firm to obtain new equipment and to modify or relocate existing facilities in order to meet new air and water pollution standards. In the industries included in this study, the pollution problems were among the most difficult and most expensive ones to correct. Forty-six corporations responded to Question 6A, and every one reported an investment in new equipment. Twenty-four of these organizations also had made modifications to existing processes or facilities. Five reported that selected operations had been shut down and five reported that entire plants were shut down. Generally, these plants contained old equipment and the expenditure for new equipment which would meet pollution control standards could not be justified. Six firms reported that facilities had been relocated.

A large number of the participants reported the actual levels of capital spending for pollution control in 1971 and estimated spending levels for 1972. Others reported spending levels for years prior to 1971 and some included their planned spending levels through the mid-1970's. A summary of the reported capital spending levels for 1971 and 1972 are shown in Table 4. Available data are shown for individual but unidentified companies in each industry and the average spending level per company is shown for companies in each industry and for all companies. Some approximations were made to obtain data for a particular year from a total reported expenditure for two or more years. The Tennessee Valley Authority was included with electric utilities, but the other miscellaneous companies were excluded.

TABLE 4  
CAPITAL EXPENDITURES FOR NEW EQUIPMENT AND PLANT MODIFICATIONS TO  
CONTROL POLLUTION\*

Industry	Spending Level (millions of dollars)	
	1971	1972
I. Automobile		
Company A	<u>70</u>	<u>85</u>
Company B	<u>55</u>	<u>70</u>
Average	<u>62.5</u>	<u>77.5</u>
II. Chemical		
Company A	10	20
" B	12	15
" C	5	5
" D	8.5	8.2
" E	20	20
" F	10	14
" G	6.6	18
" H	2	3
" I	<u>21</u>	<u>35</u>
Average	<u>10.6</u>	<u>15.3</u>
III. Electric Utility		
Corporation A	5	8
" B	11.1	--
" C	1.0	17.5
" D	7.3	49.5
" E	<u>30.9</u>	<u>26.9</u>
Average	<u>11.1</u>	<u>25.5</u>
IV. Non-Ferrous Metals		
Company A	6.7	38.5
" B	0.7	2
" C	3.5	5
" D	<u>9</u>	<u>10</u>
Average	<u>5</u>	<u>13.9</u>
V. Paper		
Company A	14	10
" B	10	15
" C	0.5	1
" D	<u>6</u>	<u>10</u>
Average	<u>7.6</u>	<u>9</u>
VI. Petroleum		
Company A	13	25
" B	--	30
" C	45	45
" D	8.5	--
" E	30	35
" F	<u>17.3</u>	<u>19.5</u>
Average	<u>22.8</u>	<u>30.9</u>
VII. Steel		
Company A	16	12
" B	<u>3.5</u>	<u>3</u>
Average	<u>9.8</u>	<u>7.5</u>
All Companies-Average	<u><u>14.8</u></u>	<u><u>21.9</u></u>

\* Some figures are estimated from the totals given for more than one year.



The summary data indicate that the average capital expenditure was \$14.8 million per company in 1971 for 31 companies and an estimated \$21.9 million per company in 1972 for 30 companies. In most companies and in every industry except steel, the expected 1972 spending levels were significantly higher than the 1971 levels, and continued high levels of spending were expected until the mid-1970's.

To indicate the pattern of capital and total spending for air and water pollution control, data from an earlier study among petroleum companies by the American Petroleum Institute, supplemented by data obtained in this study, are shown in Table 5. The total amount spent by all petroleum companies in 1969 and 1970 for air and water pollution control was approximately one billion dollars (the same amount spent in three preceding years (1966, 1967, and 1968)). However, the estimated expenditure for 1972 alone was one billion dollars. Thus, the accelerating rate of increase in spending is evident. Table 5 also includes data for four types of pollution control expenditures--capital items, operation and maintenance of pollution control equipment, administration of pollution control activities, and research and development activities. Approximately 60 percent of the expenditures in the petroleum industry goes for capital items.

The problem of developing accurate cost data for pollution control efforts is a serious one. Some companies report two or more of the types of expenditures shown in Table 5 in one figure. Also, equipment which reduces the pollution levels in air and water effluents from production plants may be new process equipment. Therefore, arbitrary decisions must be made about the fraction of the cost assigned to pollution control and the fraction

TABLE 5  
 PETROLEUM INDUSTRY EXPENDITURES FOR POLLUTION CONTROL  
 (millions of dollars)

<u>Year</u>	<u>Capital</u>	<u>Oper. &amp; Maint.</u>	<u>Admin.</u>	<u>R &amp; D</u>	<u>Total</u>
1968 - Air	112.1	41.2	12.5	21.4	187.3
1968 - Water	<u>127.6</u>	<u>58.8</u>	<u>15.9</u>	<u>2.9</u>	<u>205.2</u>
1968 - Total	239.7	100.0	28.4	24.3	392.5
1969 - Air	144.6	46.5	15.4	24.1	230.7
1969 - Water	<u>136.5</u>	<u>66.0</u>	<u>18.2</u>	<u>3.4</u>	<u>224.1</u>
1969 - Total	281.1	112.5	33.6	27.5	454.8
1970 - Air (Est.)	163.8	57.2	18.9	31.3	271.2
1970 - Water (Est.)	<u>184.8</u>	<u>77.3</u>	<u>21.3</u>	<u>5.0</u>	<u>288.3</u>
1970 - Total (Est.)	348.6	134.5	40.2	36.3	559.5
1971 - Total (Est.)					750
1972 - Total (Est.)					1,000

Source: Data for 1968, 1969, and 1970 were copied from Report on Air and Water Conservation Expenditures of the Petroleum Industry in the United States: 1966-1970, American Petroleum Institute, February 1971, p. 10.

assigned to production equipment. Also, various companies include different types of activities as pollution control projects. For example, a large utility company which reported expenditures of \$101 million for a three-year period (1969-1971) actually spent about \$70 million of this sum for undergrounding electrical transmission lines and for aesthetic treatment of buildings, substations and rights-of-way. This reflects a much broader

concept of environmental protection than most companies utilize. This same company reported \$15.1 million for research and development, but the projects listed included many technical studies that did not seem to bear any relation to pollution control. Therefore, financial data on pollution control should be treated with great caution unless definitions and accounting procedures are standardized.

Two automobile companies reported expenditures of \$135 million and \$182 million, respectively, for the relocation of facilities in 1971 and one of the firms planned to spend even more for relocation in 1972. In a large petroleum company, a one-time alteration to the distribution system (new gasoline tanks and pumps) will require an investment of \$100 million dollars over a period of eighteen months. This project is to provide gasoline which does not create as much air pollution as existing types which the company sells.

In summary, the impact of pollution control programs on capital investment requirements was great in every corporation which participated in this study. The reported average capital spending per company for pollution control was \$14.8 million dollars in 1971 and an estimated \$21.9 million dollars in 1972. This represented approximately 10 to 15 percent of total capital expenditures in several of these companies each year, with a reported range of 5 to 30 percent in individual companies. Of course, the size of the company, the type of pollution problems, the age of the facilities, and other factors affected the level of pollution control spending. In addition, the costs of operating and maintaining pollution control facilities were a significant addition to operating budgets.

Pollution Control Impacts on Products and Activities (Question #6B)

Another important area of impact of pollution control programs is that of product lines and research and development activities. Thirty-one respondents reported impacts on products, services, or activities. The major impact was an increase in spending for research and development (R and D) or a change in the type of R and D projects. Twenty-two organizations reported a change in their R and D efforts. Several firms, excluding automobile companies, reported increased expenditures in 1971 ranging from \$100,000 to \$1,400,000, with \$500,000 being the most common increase reported. One major electric power corporation reported a \$2.1 million increase in R and D spending in 1972 over the 1971 level.

The automobile companies were in a class apart from the other companies, since they have been making a major effort to meet strict motor vehicle emission standards by 1975. This has caused them to increase sharply their research and development efforts. One automobile company reported expenditures of \$82.5 million in 1971 for increased R and D efforts and for modifications in product design. The same firm planned to spend \$137.9 million on these activities in 1972 and a major competitor estimated their expenditures would be \$182 million in 1972 for emissions control R and D and related activities. An Inter-Industry Emission Control project spent \$12,000,000 on research from 1967 through mid-1971. This is an eleven-company international program which was launched by Mobil Oil Corporation and Ford Motor Company.

A chemical company was working to develop auto exhaust catalysts and water treatment processes. A paper company, in a joint company-state

project, was trying to develop a new product from solid wastes such as fly ash, fibers and chemicals. Two utility companies had spent \$1 million and \$2 million, respectively, on thermal effects research. A petroleum company was conducting research on coal gasification and the low-sulphur lignite fields of the Dakotas in a search for substitutes for scarce natural gas. Two other petroleum companies reported that total spending for R and D had not changed, but the type of research had changed to reflect environmental concerns. One of these firms said that the research effort would not diminish for the next 3 to 6 years.

Consolidated Edison Company of New York, along with Atomics International Division of North American Rockwell and Northwest Utilities, had started a \$4 million pilot plant R and D project to remove  $\text{SO}_2$  from power plant stack gases. Con Ed was also studying the use of waste heat from power plants and energy conversion systems. Other R and D studies by utility companies include water recirculation, cooling tower water disposal, radionuclide uptake in marine organisms, climatological surveys, atmospheric diffusion, equipment design and fuels. One utility started a \$10 million, ten-year breeder reactor research program in 1971. Seventeen utilities are sponsoring a \$7 million program by Babcock and Wilcox and Esso Research and Development to develop an air pollution control system capable of removing 99% of the fly ash and 90% of the  $\text{SO}_2$  from boiler flue gas. Salable sulfuric acid would be produced, according to one respondent, and "if the results of this project are favorable, a practical commercial system may be available by 1975."

Twelve firms reported the addition of new products or services as a result of their pollution control efforts. Some developed instruments or

control devices for their own operations and then started to produce and sell the same items to other companies when a significant demand existed. For example, Monsanto Company formed a subsidiary, Monsanto Enviro-Chem Systems, Inc., to design and build various types of large and small pollution control systems and to sell pollution control equipment and services.

One petroleum company had patented more than 20 pollution control methods or devices, and had patents pending on many others. An industrial equipment producer was working to develop products which would assist other corporations in meeting pollution control standards. Products for sale or in development included air purification and odor control systems, and boilers which produced heat by burning coffee grounds and other waste products. The big product impact in petroleum companies was the introduction of lead-free or low-lead gasolines. One petroleum company had also developed a lead filter for auto exhaust systems and a new ignition system to permit auto engines to operate efficiently on lean mixtures of fuel.

Four companies reported increased sales of existing products or services, six said they had deleted some products (such as pesticides), and six said they had modified their product design or packaging. No reports of mergers were received, but one paper company in the initial mail survey reported they had merged with another paper company. Pollution control impacts was a likely contributing factor.

In the first quarter of 1972, the boards of directors of Tenneco, Inc. and Westinghouse Electric Corporation approved the formation of a joint

venture to manufacture offshore nuclear electric power plants. This new venture, to be called Offshore Power Systems, was a direct result of environmental concern about land-based nuclear power plants.

Other impacts reported included:

- (1) a significant expansion of scrap aluminum can recycling,
- (2) a new process was developed by Reynolds Metals Company for fluxing and degassing molten aluminum to reduce pollution levels in air effluents,
- (3) a change in purchased fuel specifications; one utility reported they had "negotiated a firm contract for a premium low sulphur, low ash fuel oil."

In summary, major efforts have been underway in all of the industries studied during the last few years to develop or modify products and processes in order to reduce the levels of pollution produced. Research and development spending has been increased significantly and research studies have been designed to find new and less expensive solutions to the vast range of environmental protection problems which exist today. This effort will continue at a high level for many years.

#### Pollution Control Impact on Corporate Performance (Questions #6C, #7, and #8)

Twenty companies responded to the question on profitability change and 15 of these indicated that profits had declined in 1971 as a result of pollution control efforts. Only one company reported no change in profitability and return on equity. The other four did not indicate the direction of change.

The largest change was a \$7.6 million decline in profits in 1971 in a non-ferrous metal producer due to increased operating costs. Another firm in this industry reported a 5 percent decline in profits in 1971, while two other similar firms reported slight decreases (one of 0.5%). Two large pulp and paper producers each reported a decline in profits in 1971 of \$3 million and an expected decline in 1972 of \$3 million. One other paper company reported a decline, but did not quantify it.

One chemical company reported a decline in profits of \$2 million in 1971 and the same expected decline in 1972. Two other chemical companies reported declines in 1971, but another said they had experienced no change. A utility indicated profits were \$1.2 million lower in 1971 and were expected to be \$1.7 million lower in 1972. One steel company said profits were \$500,000 lower in 1971 and would be down the same amount in 1972. An auto company experienced declines in profitability in 1971 and 1972, and two petroleum firms reported declines in 1971 (one said there was a big decrease).

Most of the same firms which reported declines in profits also reported declines in the return on owner's equity. This was expected, of course, unless the equity base was also reduced. One paper company said the rate of return was down about 1% in 1971.

The decline in profits was due in part to higher costs of operating and maintaining pollution control equipment. Some companies also had sizeable writeoffs of equipment and facilities which were taken out of service due to pollution problems or excessive replacement costs. The large investments by every company in new capital equipment and plant



modifications for pollution control also had a big impact on profits. However, the amount of the impact will vary with the accounting procedure used.

Most companies depreciate capital items rapidly, so the impact on profits would be greatest in the early years of the asset's life. Also, the tax laws on depreciation are changed periodically and these changes often affect a company's profitability in a given year. One staff engineer from a petroleum company reported that the 1969 Tax Reform Act permitted a rapid depreciation (over a five-year period) of pollution control equipment if it met certain rigid qualifications. He said this option had not been used much yet, but is likely to be used more in the future.

The same engineer also discussed the difficulty of finding the net cost of pollution control equipment, which should be derived from original cost less savings or the value of benefits. To find the savings in a chemical processing plant, the possible benefits to be included are:

- (1) the value of salvaged chemicals,
- (2) the value of improved product quality,
- (3) the value of higher operating efficiency, and
- (4) the value of new required processing functions performed by the new equipment.

Thus, accounting options and tax laws "complicate" the impact of pollution control on profitability.

The question about the change in average production costs per unit of product in 1971 (#7) due to pollution control activities drew 28 responses,

and all except one said that unit costs had increased. One chemical company reported that production costs were lower by approximately 0.5% (apparently due to higher operating efficiency or offsetting revenues from salvaged chemicals).

The greatest increases reported was 25% by an auto producer and 20% by a non-ferrous metals producer. Two paper companies reported cost increases of 12.5% and 10%, respectively. A chemical company and a steel company reported increases of 5%, and 18 other companies reported cost increases ranging from 0.5% to 3%. One paper company said the cost increase had been \$5/ton and three other companies did not quantify their reported increases. The impact of pollution control measures on production costs varies widely between products and plants, as indicated by some respondents. However, cost increases seem likely as a general pattern for several years, and the vice president in a non-ferrous metals company has estimated that "meeting the standards for air and water emissions which are already adopted (as of December 1971) or are in immediate prospect will add about 15% to industry product costs by 1975."

In the motor vehicle industry, the accumulated cost of emission control devices is expected to be \$314 per vehicle by 1975, according to a study committee of the National Academy of Sciences. Their cost estimates by year are shown in Table 6. These devices will be necessary to meet the air pollution standards for motor vehicles in 1975.

The impact of pollution control on product prices (Question #8) was surprisingly small. Of the 28 companies that reported cost increases in

TABLE 6  
ESTIMATED COSTS PER VEHICLE FOR EMISSION CONTROL DEVICES  
TO MEET 1975 STANDARDS

<u>Year</u>	<u>Yearly Cost</u>	<u>Accumulated Cost</u>
1966	\$ 3.00	\$ 3.00
1968	15.00	18.00
1970	8.00	26.00
1971-1972	14.00	40.00
1973	60.00	100.00
1974	20.60	120.60
1975	193.40	314.00

Source: Semiannual Report by the Committee on Motor Vehicle Emissions of the National Academy of Sciences to the Environmental Protection Agency, (Washington, D.C., 1972).

1971, only 8 reported price increases, and these were all 1% or less, except in two companies. The auto company which reported a 25% increase in costs also reported a 25% increase in price. The time frame for this large increase was unclear, in view of the price control measures in force by the federal government. The other significant price change was a 3% increase in one utility company. Thus, it seems that cost increases are not passed on to the customer as price increases in many companies, and several respondents stated that this could not be done due to competition in the market place, both foreign and domestic. For example, a price decline of 10% and a cost increase of 20% was reported by a non-ferrous metals producer. The respondent commented that the "prices of metals are determined by international supply and demand characteristics, not costs."

Price increases to compensate for pollution control costs are most likely in government-regulated industries like the electric utility industry. The results of this study support that conclusion, for 3 of 5 utilities which reported cost increases in 1971 also reported price increases. No price increases were reported by companies in the paper, steel, and non-ferrous metals industries, and very slight increases were reported by 2 chemical companies and 2 petroleum companies. Utility rate increases have been allowed in the recent past to be used specifically for pollution abatement, according to George R. Perrine, president of Midwestern Gas Transmission Company.\*

In summary, product costs have increased in most of the companies studied, but product prices have not increased, except in a few cases, due to competitive pressures. Therefore, profits and the return on owner's equity have decreased in many of these companies. The economic impact of environment protection efforts on corporation performance has been great and will continue to be significant. However, accounting variations, hard-to-measure benefits, and tax laws make it very difficult to determine pollution impacts accurately.

#### Pollution Control Impacts on Management Systems (Question #6D)

By far the biggest impact on management systems has been the addition of pollution control specialists, research personnel, top executives, and

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\* An article by Mr. Perrine appeared in the Winter, 1970 issue of Tenneco, a publication of Tenneco, Inc.

policy or review committees to deal with environmental protection matters. Thirty-three companies reported additions to their organizations. Ten companies reported changes in planning criteria, ten reported changes in top management philosophy and policies, and four mentioned other impacts of the pollution control movement.

A striking reflection of the growing number of new environmental protection staff departments in industrial corporations is found in the job titles of the survey respondents shown in Appendix D. Since many of the individuals who fill these positions perform a central coordinating function for environmental protection activities, they were logical choices in many companies to complete the questionnaire mailed to the president.

Many new "environmental protection" departments were established in 1971 and several existing departments were enlarged by personnel additions. The names of several relatively new departments of this type are shown in Table 7. All of these groups appear to be corporation staffs located at a central point (including Washington, D.C.) to coordinate all environmental protection activities in the entire company. Many firms have additional staff specialists in each division and at various plant sites. For example, one large petroleum company has a "Directory of Selected Personnel Involved In Environmental Conservation" which contains 129 names, in addition to key committee members. Only 7 of these persons are members of the corporation staff group.

The functions of these central coordinating staffs in various companies were quite similar. To illustrate the type of functions performed, the duties of the director of a new Industrial Ecology Department were to:

TABLE 7

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"ENVIRONMENTAL" DEPARTMENTS IN INDUSTRIAL CORPORATIONS

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Department of Public Responsibility  
Environmental Service Department  
Office of Environmental Affairs  
Environmental Services Division  
Environmental Protection Department  
Environmental Conservation Department  
Environmental Control Department  
Department of Air and Water Control  
Environmental Control Division  
Office of Coordinator of Air and Water Conservation  
Environmental Control Section  
Environmental Conservation Department  
Environmental Protection Department  
Environmental Control Division  
Environmental Quality Department  
Industrial Ecology Department

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- (1) keep abreast of the legal aspects of pollution control--testimonies, petitions, permits, proposed legislation, etc.,
- (2) serve as a communications center to help operating units share ideas and pollution solutions,
- (3) coordinate problem solving efforts by pulling together key people in the company,
- (4) assist the advertising and public relations units to reflect "integrity" in their outputs,

- (5) help lower level operating units reflect the proper concern over environmental problems in their plan and policies, and
- (6) seek to achieve "stability" in dealing with pollution problems by damping emotional behavior in relations between operating units and control agencies.

The functions were similar in the somewhat "older" Environmental Conservation Department of Shell Oil Company, as shown in Appendix J.

Many of these corporate staffs reported to high-level officers, and one unit was transferred to a senior operating officer in 1971. For example, in companies in four different industries, the environmental protection units reported to the President, Executive Vice President for Environmental Affairs, Senior Vice President for Research and Engineering and Vice President, Environmental Control, respectively. This placement in the organization reflected the importance of the function and the need for uniform policies and actions.

Four companies reported expansions of their Environmental Control staffs in 1971, and one firm added accounting specialists to its staff for more intense cost-benefit analysis. Several companies had also established high-level committees in recent years to set pollution control policies and to review plans for capital investments and operations. The names of these committees are shown in Table 8.

Research and engineering staffs had also been expanded. Motor vehicle companies increased their emission control research and development staffs at an amazing rate over the past few years. The change in

TABLE 8  
"ENVIRONMENTAL" POLICY OR PLANNING COMMITTEES  
IN INDUSTRIAL CORPORATIONS

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Environmental Control Council
Environmental Control Committee
Clean Environment Committee
Corporate Environmental Planning and Protection Committee
Environmental Control Committee
Environmental Council
Air and Water Planning Group
Environmental Conservation Committee
Oil Spill Committee
Automotive Emissions Committee

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the number of people in this function in one company for the past 6 years, shown in Table 9, is a good indicator of the intensity of effort to meet tighter auto emission standards as new laws were passed. One utility company formed a small, highly specialized R and D staff in 1970 to study energy production, distribution and use, as well as pollution control problems.

Changes in planning criteria were indicated by several respondents. In one chemical company, the impact on the environment of every investment proposal is considered and the manager who submits such a plan must include a paragraph on environmental effects. Another large, diversified company also requires in investment proposals a certification that proposed plants will not have pollution problems.



TABLE 9  
EMISSION CONTROL R AND D PERSONNEL  
IN ONE AUTOMOBILE COMPANY

<u>Year</u>	<u>Number of Persons</u>
1967	1,041
1968	1,196
1969	1,523
1970	1,892
1971	2,972
1972	4,745

The respondent from another chemical company said that, in planning, "environmental aspects are just as important as the market aspects." A non-ferrous metals producer said that, since 1967, planning for mineral development has included:

- (1) an inventory of the ecological system,
- (2) an analysis of environmental impacts, and
- (3) an estimate of the cost to preserve the environment.

Another company said that possible acquisitions were reviewed for environmental problems, and another reported that environmental considerations were now included in the criteria used to select new plant sites.

In discussing changes in top management philosophy and policies, the general pattern of replies was that pollution control now has the full attention of top management and is given top priority. One respondent from a chemical company said that "explicit consideration to the side effects of corporate actions has continued to grow." An automobile company

reported that pollution control was "formerly an engineering interest primarily, but now every aspect of the company is involved; it is discussed in practically every meeting of the Board of Directors." A petroleum company said that top management spends more and more time on conservation practices.

Pollution control efforts have also had an impact on management training needs. One chemical company reported plans for "a three-day pollution seminar (in 1972) for plant managers in the United States to review (company) policies, procedures, and the role each manager must assume in seeing that we conduct ourselves as good corporate citizens."

Pollution control programs have also affected company advertisements. For example, an ad by General Motors Corporation in the December 1972 issue of Fortune (p. 20) has a special block on air pollution control in which auto drivers are encouraged to help. Duke Power Company has conducted "a concentrated newspaper and TV advertising program" about its pollution control efforts. This type of advertising is probably done to keep customers and the general public informed, to improve the public image of the company, and possibly to justify future rate increases. Some companies, including International Paper Company and General Motors Corporation, print pollution control slogans on metered postage stickers which are attached to outgoing mail. This seems to be part of each company's public relations activities.

A major policy change in Consolidated Edison Company of New York and in other utilities has been to stop advertising which encourages a greater consumption of electricity. In 1971, Con Ed discontinued its Sales Department and began a "Save-A-Watt" educational campaign on the need to save

energy of all kinds and how to do it. The company also asked the Public Service Commission to reduce the quantity discount for large users of electricity in an effort to encourage greater efficiency in energy consumption. Another large utility has taken an opposite position, stating that "reduced rates for increased usage reflects actual economies in distributing greater amounts of electricity and that to raise price levels beyond the dictates of costs causes a dislocation of resources and should be avoided."

Another impact of pollution control efforts in the petroleum industry has been the creation of two multi-company insurance plans to provide compensation for oil spill cleanup costs and damage.

In summary, the management systems in the industrial firms studied have been affected in many significant ways by the environmental protection movement. The greatest impact has been to create many new organizational assignments, but planning criteria and operating policies and procedures have also been modified.

#### Views on Various Governmental Pollution Control Plans (Questions #9 and #11)

When asked to express their personal views on the degree of desirability of various methods of providing positive and negative incentives to motivate managers to control pollution, the respondents were not unanimous in their positions, but some definite preference patterns emerged. A summary of the views of respondents on each government action suggested in the questionnaire is given in Table 10. Those who circled +1, +2, or +3 viewed favorable a given plan, and those who circled -1, -2, or -3 viewed a plan with disfavor. When a viewpoint was expressed for or against any plan without an

TABLE 10  
VIEWS OF RESPONDENTS ON GOVERNMENT INCENTIVES  
TO CONTROL POLLUTION

Government Incentive (Negative and Positive)	No. of Respondents Expressing Each View						
	Degree of Desirability						
	<u>-3</u>	<u>-2</u>	<u>-1</u>	<u>0</u>	<u>+1</u>	<u>+2</u>	<u>+3</u>
1. Pollution Tax	15	4	4	1	2	2	0
2. User Fees--Municipal Waste Treatment	2	1	2	1	10	6	7
3. Fines for Non-Compliance	1	2	5	4	12	4	1
4. Effluent Monitoring, Shut Down Authority	7	2	3	1	9	5	2
5. Effluent Discharge Permits	1	2	4	7	6	5	3
6. State Equipment Financing	6	1	2	3	7	2	5
7. Accelerated Depreciation	0	0	1	2	6	6	14
8. Income Tax Credit	0	0	0	2	7	6	12
9. Cash Rebates	5	5	2	7	6	0	3
10. Government-Paid Consultants	11	5	5	3	2	0	0

indication of the degree of desirability, the response was included with those who circled +1 or -1, respectively. Those who circled 0 were either indifferent about a particular plan or had no opinion to express.

Some of the suggested plans are currently in effect and others have been proposed or discussed as possible actions that governmental units (federal, state, or local) could take in an effort to control various types of pollution more effectively. Some are classified as negative incentive plans, if they impose some penalty on the polluter, while others which provide rewards for positive actions by managers to control pollution are called positive incentive plans. In Table 10, plans 1 through 5 offer negative incentives and plans 6 through 10 offer positive incentives.

Among the plans which penalize polluters, the pollution tax was viewed with the greatest disfavor. Twenty-three of 28 respondents were opposed to such a plan, and 15 were strongly opposed. Several reasons were given for this opposition, as reflected in these comments:

- "too difficult to determine"
- "tax will not accomplish the desired goal"
- "tax of such character is considered unethical as well as impossible to administer equitably"
- "a pollution tax requirement could never be written or enforced"
- "foolish--tax will be passed on to customers through higher prices"
- "not fair to older plants"
- "decreases amount of capital available to install pollution control equipment"
- "not effective--like paying to sin."

One respondent said that a pollution tax would be "justified only if a (pollution) problem appears amenable to solution and there is no other route to obtain funds for required technology."

Most respondents favored a plan for charging fees to industrial firms whose wastes were treated in municipal or regional facilities. Twenty-three of 29 views expressed were positive. One respondent said they were doing this in some locations now. Another stated "that if wastes are compatible, they should be treated together for economy, for a higher degree of treatment, and for other reasons." He cautioned, however, that "one waste may be toxic to another" and said "that municipal treatment may be desirable in

some places, but not in others." Another justification for this plan was that it "reduces the need for capital investment." Also, efficiency can be maximized in a treatment plant with a favorable size to operating cost ratio. One respondent thought that county taxes should cover the cost of industrial waste treatment; however, he recognized that "a large plant in a small community presents some difficulty." Another reply said the plan had merit, but that problems related to priorities, volume, and fees would exist. One person who viewed the plan favorably thought the small operator should be an exception. An exception to the majority view was that of a top executive in a paper company. He wanted nothing to do with a municipal treatment facility. He felt that costs would increase steadily, that contracting problems were likely, that one plant couldn't handle all pollutants, that pre-treatment would be necessary, and that political problems would exist. He concluded that "when you get hooked up with a political system, you are asking for problems."

Fines for non-compliance with regulations were viewed favorably by the majority (17 of 29), but 8 were opposed and 4 were indifferent. One respondent said that fines were "normally expected under legal procedures." Others favored fines if "safeguards" or "access to an appeal procedure" were provided. Other reservations were that "control standards would be technically, not politically, established" and that the "violation would bear on some real aspect of environmental quality." Others said that fair administration and clear interpretation of regulations were necessary. One company president felt that fines should be handled through courts of

law instead of government bureaucratic control. He said that much inequity existed when fines were imposed by administrative personnel, and cited an instance where two companies paid significantly different fines for the same violation when two different inspectors were involved. Some expressed strong opposition to fines, and one opponent said "if penalties would stop undesirable action, we wouldn't have any murders or other crimes." Another opponent said that "fines are another form of pollution tax--if set too low, they would be ineffective and if set too high, the company would have to shut down anyway."

The views were mixed on effluent sampling or monitoring and shut down authority, with 16 in favor, 12 opposed, and 1 indifferent.. Some considered the two parts of the plan separately. None was opposed to monitoring by government agencies for control purposes, but one respondent felt it should be the responsibility of plant operators. However, several reservations were expressed about shut down authority. Replies indicated it "should be subject to due process" or "judicial restraint," used only for "emergency situations," "extreme circumstances" or "when serious incidents occur." "Fair administration" and "rational decisions" about shut downs were also desired. One respondent felt that shut down went "too far," but others were strongly in favor. One executive said "we will comply" if operations may be shut down, for "that is our bread and butter." Another respondent liked the way the law is written now, with shut down authorized if not in compliance by a certain date. Still another felt this method, now in operation, will be used more and "will be the only way to control pollution." He cited the effectiveness of

the plant shut downs in Birmingham, Alabama in 1971 and said "you must get people's attention and shut down does it."

Mandatory effluent discharge permits were viewed favorably by 14 respondents and unfavorably by 7, with 7 others uncertain or indifferent. One favorable factor cited was that permit requests are judged on an individual basis and the assimilative capacity of streams is taken into account. A similar comment was that permits were the "best way to assure proper assessment of the pollution effects of a given discharge." Several referred to the application of the 1899 law which required permits for outfalls which emptied or drained into any navigable stream. Every major industry had to apply for such permits by July 1, 1971, and the expense of obtaining laboratory analyses of effluents and of filling out thousands of applications was very high for some companies. Respondents did not like to incur these expenses and did not like the way the requirement for permits was handled, but one said that "permits are a necessary evil, because an inventory of pollutants is necessary and this is the best way to find out what they are." Another respondent felt that the applications would take years to process and that all data would be out of date by that time. Still another felt the 1899 law was a very potent one and its current use is "another way the federal government can get at anything they want to." One person felt this application was a misuse of the law, but that it "gave a handle for the pollution problems." Another said that the impact has been to force business firms to admit how many outfalls they had, and to "tighten up" (reduce the number of) their outfalls.



Governmental financing of pollution control equipment was viewed favorably by 14 respondents and unfavorably by 9, with 3 indifferent. One interviewee in a paper company said that such a plan was working fine in Ohio and would be very desirable. He said that it offers these advantages:

- a. the investors are happy--they get tax-free bonds,
- b. the state is happy--pollution problems are solved quicker, and
- c. the company is happy--financing costs may be lower, scarce capital is conserved, and the return on equity does not decline as much.

Officials in Ohio were contacted to learn about their plan, and they reported that two separate authorities had been established (in 1968 and 1970) which are empowered to issue tax-exempt industrial revenue bonds for the purchase and construction of air, water, and solid waste pollution control facilities. In the last quarter of 1972, the Ohio Water Development Authority had 15 industrial solid waste or water projects underway which cost \$43,000,000 and the Ohio Air Quality Authority had 7 projects underway which cost \$6,000,000, and much more interest was expected since the state recently passed air quality regulations. The smaller, financially-pressed companies are especially interested in this type of government support. A respondent in another paper company said it is "important to provide an incentive and lighten the abatement burden on marginal companies." A steel company representative said that "in the steel industry, it is generally recognized that some sort of financial assistance will be necessary." An instance of such assistance

was reported by Jones and Laughlin Steel Corporation to its stockholders recently. The company completed a \$17.5 million industrial bond financing in May, 1972 to construct air and water control facilities, selling bonds issued by a County Industrial Development Authority. Two opponents of such government financing said it "could only mean a higher societal cost" and that it "weakens the free enterprise system's social responsibilities."

Almost all respondents favored the accelerated depreciation plan and the income tax credit plan for investment in pollution control equipment. One respondent said that both would help cash flow, but that only the tax credit plan would improve earnings, since rapid depreciation increases expenses for accounting purposes in the short run. However, in the long run, the total depreciation expense for a given capital good would not change, and the tax savings in the early years of the asset's life would provide a tangible benefit due to the time value of money.

Cash rebates for pollution control equipment purchases were viewed unfavorably by 12 respondents and favorably by 9, with 7 indifferent. Objections were that such a plan would permit unscrupulous activity and that the problem of defining pollution control equipment (or deciding what fraction of new process equipment was for pollution control) would be a very difficult one. One respondent who favored cash rebates said it "would allow us to more gainfully employ our money."

Twenty-one respondents did not favor government-paid consultants, while 3 were indifferent, and only 2 expressed mild approval. One opponent asked "why should a company have a paid consultant when their

competition has their own?" Another feared that the decisions of such consultants could become binding. Another felt they could not be objective, but conceded that they might be desirable for small companies. Still another said they would be only a "paid bureaucracy."

Another plan proposed by one respondent was the use of "reasonable regulations enforced by injunction," which is similar to granting shut down authority. Another proposed that "local communities solve the problems under Federal guidelines." Subsidies and grants for industrial waste treatment facilities were also proposed.

General comments on incentives were strongly in favor of positive measures to motivate companies to control pollution. One respondent said that "economic disincentives, like a tax on lead in gasoline or the sulphur content of fuel, are not desirable." He added that "a company should profit by doing the right thing." Another said that "history shows that punitive measures are far less effective than a system of rewards in all forms of human activity." Finally, the president of one company said that "the key to pollution control is integrity; if a company does not want to be a good corporate citizen, it is hard to make them."

In summary, the respondents were strongly in favor of accelerated depreciation and income tax credit for pollution control equipment. They also generally favored user fees for municipal waste treatment, fines for non-compliance with regulations, and mandatory effluent discharge permits. A slight majority favored effluent monitoring and governmental shut down authority, as well as state equipment financing, but several were strongly opposed to these plans. There was strong opposition

to a pollution tax and to government-paid consultants. A majority also opposed cash rebates for purchased pollution control equipment.

Company Concerns About Environmental Protection in the Future (Questions #10 and #12)

Forty-three respondents expressed one or more concerns (Question #12) about future developments and existing problems related to environmental protection. The number of respondents which indicated each type of concern listed in the questionnaire is shown in Table 11. The frequency of responses about each area of concern is probably a good index of the overall relative importance of each concern in the industries studied.

The major area of concern, as indicated by the three items checked most frequently, is pollution control standards. Concern about shifting standards was checked most often (34 times), unrealistic (excessively tight) pollution standards was checked almost as often (31 times), and pending legislation (which deals largely with standards) was third in frequency (25 times). Closely related to pollution control standards is the new equipment which must be purchased to meet the standards. This required investment was the next concern in terms of frequency of response (22 times). Then profitability (11 responses), unfair enforcement of laws (8 responses), and company survival (7 responses) were next in importance. The items of least concern were product line and product design changes (4 responses each), required facility relocations (3 responses), and reductions in personnel (one response). Fifteen respondents mentioned other areas of concern.

TABLE 11

FREQUENCY OF VARIOUS CONCERNS RELATED TO ENVIRONMENTAL PROTECTION  
(RESPONSES TO QUESTION #12)

<u>Area of Concern</u>	<u>Number of Respondents Expressing Concern</u>
Shifting Pollution Standards	34
Unrealistic Pollution Standards	31
Pending Legislation	25
Investment in Equipment	22
Low Profitability	11
Unfair Enforcement of Laws	8
Company Survival	7
Product Line Changes	4
Product Design Changes	4
Facility Relocation	3
Personnel Reductions	1
Other	15

The major concern about shifting standards was that new equipment purchased in the future would be obsolete before it was used very much, due to tighter new standards which could not be met. Thus, the money spent would be largely wasted. This has happened often in the past, according to the respondents. One person said that "approved equipment is obsolete by the time it is built." Another said that "industry was not reluctant to conform; the big problem is to find out what to conform to--you are shooting at a moving target." In some instances, standards have been lowered (mercury, phosphates in soaps), but in most cases, they have become more restrictive over time.

There was considerable concern about the tightness of standards and the ability of companies to meet them, but there was also much concern about how the standards were determined. One person said the "basis of law is more of a problem than the degree of restriction." Another said that standards were "not related to ambient quality effects." Failure to consider "background" pollution was implied by one respondent who was concerned over pollution standards, "particularly in areas where standards could not be met if there was no industry." Concern was expressed that standards were "arbitrary and inflexible" and were not based on a "cost/benefit criterion." The "tendency to overkill" was mentioned and the feeling was expressed that standards were "set by (uninformed) politicians instead of (informed) scientists and engineers." This concern over the technical validity of standards was expressed several times. The vice president of a non-ferrous metals company said "we are committed to the support of reasonable ambient and source emission air standards; on the other hand, we are positively opposed to standards based on the assumed significance of incomplete data accumulated by unscientific methods from doubtful sources." The technical feasibility of ever meeting standards could not be assured in some instances. One respondent suggested that "a public forum was needed to bring all parties with a concern together so they could set reasonable standards."

The concern over pending legislation pertained to several bills--zero water pollution discharge, land use, elimination of mineral resource development potential, water quality and toxic substances, and

a "plethora of poorly-based state legislation." However, the greatest concern was expressed over the zero water pollution bill or Muskie Bill (S.2770), which was the subject of Question #10. Therefore, all comments made by respondents on this particular legislation will be combined in this section. Responses from representatives of 31 companies about this bill were received, and practically all of them expressed strong opposition to the bill.

This legislation (S.2770) has passed in the U.S. Senate and similar bills are pending in the U.S. House of Representatives. The Senate bill establishes as national policy the goal of achieving water quality that would allow swimming and fish propagation in all waters by 1981, and the goal of completely eliminating the discharge of water pollutants by 1985. Industry would have to install the "best practicable" water treatment systems in all facilities by 1976 and the "best available technology by 1981." Several of the comments of respondents are quoted below to indicate most accurately the prevailing view in industry about this bill:

--"impossible and unrealistic; will work against our orderly program to reduce water pollution from our plants and factories"

--"very poor; will result in law by administrative interpretation"

--"zero (pollution) as a goal may be O.K., but, as a practical matter, is unattainable; the 1981 requirement for the best available technology, regardless of cost/benefit, is the killer in the bill"

--"zero discharge is scientifically impossible and economically ridiculous"

- "the 'zero water pollution' aspect is not realistic or necessary to achieving a desirable quality of water; extremely costly, consequently a waste of resources"
- "strongly opposed; the costs would far outweigh the benefits, diverting resources from social objectives of higher priority"
- "a totally ridiculous and unworkable idea; unsound because of energy requirements"
- "objectionable--increased costs would price company out of business in world markets"
- "highly impractical--it's trying to legislate technology; it is short sighted and gives absolutely no consideration to our energy crisis or other related problems"
- key concerns--"what is a pollutant?" "what is economic reasonableness?"
- "it seems unrealistic and single-valued, considering the full back-drop of social problems, to undertake this costly 'super-pure' water program while other social-environmental problems are neglected"

Several top executives of industrial corporations have made public addresses and have testified before congressional committees to assert their opposition to the "zero water pollution" bills. For example, John T. Conner, Chairman of the Board of Allied Chemical Corporation gave an address on January 6, 1972 entitled "Zero Discharge: National Goal or National Calamity?" He expressed strong opposition to these bills and condemned the proposed approach of "flying blind." Two respondents expressed the view



that the House bill (H.R. 11896) was more workable and desirable than the Senate bill, but it was also considered unrealistic.

The concerns relating to very large capital investments and profitability were discussed in an earlier section. Companies classify these investments for pollution control equipment as "unproductive," meaning that they generally do not increase or improve the tangible outputs of a production system. However, from a social accounting view, these investments reduce the harmful or negative outputs of production systems and would thus be "productive" to society.

Among those who were concerned about unfair enforcement of pollution control laws was one automobile company spokesman who thought there was an overemphasis on auto pollution. He claimed that "in most places, there is zero control of hydrocarbon emissions from stationary sources; 98% control of hydrocarbons is mandated by Clean Air Amendments of 1970 versus automobiles alone--this is typical."

Some respondents felt that the "survival of basic industry in the United States" was at stake in the fight to protect the environment. At least one respondent in each of the industries surveyed except the automobile industry was concerned about survival. Paper companies were especially concerned about the squeeze they face from higher operating costs on one side due to pollution control efforts and from competitive price pressure applied by foreign producers who do not face such strict pollution control standards. A major study was underway in the paper industry in 1972 to determine the impact of pollution control on international trade. Some representatives of this industry stated the dilemma in the communities

where their plants are located as one of jobs vs. environmental quality. Another respondent from a paper company said the Muskie Bill could put most paper companies in the 'red' and would cost his company \$200,000,000 for required new equipment.

The petroleum industry has been affected most by product line changes, since they have had to introduce lead-free or low-lead gasolines. The automobile industry has also been affected significantly by product design changes which have been made in an effort to meet stricter auto emissions standards.

Other concerns were added to the list on the questionnaire by several respondents. They included:

- (a) international trade impacts (petroleum company),
- (b) costs of low sulphur fuels to meet regulations (utility),
- (c) lack of knowledge among the citizenry about pollution control costs and sources of pollution (chemical company),
- (d) the pursuit of ideal objectives without concern for costs (non-ferrous metal company),
- (e) unrealistic deadlines for major facility construction or modification (non-ferrous metal company),
- (f) time delays in obtaining decisions from state and federal authorities (2 paper companies),
- (g) different time period for compliance with standards for each of two pollutants produced by the same boiler (paper company),
- (h) lack of cooperation on the part of a federal government agency which controls the river flow rate (paper company),

- (i) impractical water pollution laws in Tennessee (paper company),
- (j) difficulty in satisfying 2 federal agencies and 1 state agency; the requirement for state and federal permits (paper company),
- (k) more goods and less pollution are incompatible goals (petroleum company),
- (l) blocking of plant location and construction by environmental radicals (petroleum company),
- (m) government efforts to regulate the means by which standards are achieved (petroleum company),
- (n) much overlap, disparity, and duplication between state and federal pollution control agencies (3 companies), and
- (o) the need for reliable cost-benefit analyses as a basis for control actions.

In summary, the respondents were most concerned about pollution standards--their severity, their rigidity, and their instability. They were also concerned about the major investments in new equipment required to meet these standards and the impact on profitability. Several also felt that the survival of some companies was at stake. In addition, several concerns were expressed about administrative problems, operational impacts, and goals in pollution control programs.

Pollution Control Actions in Corporations--Past and Future (Questions #13 and #14)

The major concerns in the automotive industry are (1) to design and build motor vehicles which comply with federal emission control standards

and (2) control air and water pollution from manufacturing plants. In the first area, the size of the R and D staffs and the spending levels for R and D have increased dramatically in the last few years, and "tremendous expansion" is expected to continue each year until 1976 models are designed. One company had over 4,700 people working on this problem in 1972 and planned to spend about \$138 million. In the area of plant pollution control, one company spent \$107 million before 1971 and another spent \$50 million for new pollution control equipment and plant modifications.

In the petroleum industry, the major effort has been to purchase and install pollution abatement equipment in refineries and oil production facilities. Also, the spending levels for research and development have increased and more research effort pertains to pollution control. In total, the industry spent over \$2 billion for air and water conservation (pollution control) during the five-year period from 1966 through 1970. This sum included capital spending and the costs of operating and maintaining pollution control equipment, the costs of administration, and the costs of research and development. The spending levels have increased each year since 1966, and climbed to about \$750 million in 1971 and \$1 billion in 1972 for the entire industry. One company reported a spending level of \$50 million per year for pollution control, about 10% of total capital spending. Also, staff groups engaged in pollution control activities have expanded rapidly and increased emphasis has been placed on employee awareness and training about pollution control concerns. New

low-lead and lead-free gasolines have been introduced to help reduce air pollution from motor vehicle exhaust gases.

Firms in the chemical industry have also spent large sums for pollution control in their manufacturing plants. One company reported that \$50 million had been spent in the years preceding 1971, and the average planned capital expenditure in 1972 for each of 9 participants in this study was \$15.3 million. To indicate the rapid rise in spending, one chemical company spent \$1.4 million in 1969, \$4.5 in 1970, and \$8.5 million in 1971 to achieve compliance with state and federal pollution abatement rules and regulations. Another firm reported that 230 environmental control projects were scheduled for a three-year period starting in 1971. One company reported that actions in 1969, 1970, and 1971 had been to control mercury emissions in the water and the air, to control SO<sub>2</sub> emission from a sulphuric acid plant, and to discontinue the manufacture of soda ash and chlorine at one location. In the future, they planned greater control of pH, suspended solids, fluorides, water temperature, BOD load, and ammonia. Environmental control personnel have increased and training programs for plant personnel have been implemented. Plant surveys and forecasts of pollution abatement requirements have been made. One respondent summed up plans for the future as "more; faster; better."

Utility companies, including the Tennessee Valley Authority, have concentrated on reducing air pollution, although some firms have also installed waste water treatment facilities and new equipment in recent years. One company completed a new land fill and cover project for

fly ash disposal. Electrostatic precipitator installations and boiler conversions to burn oil instead of coal have been common. Some utilities have completely converted to oil and others will discontinue or restrict further the use of coal in the future. More precipitator installations are planned for future years and greater dependence on nuclear power plants is expected. Air pollution abatement equipment and waste water treatment facilities will be updated, and one corporation reported plans for a \$35 million full-scale  $\text{SO}_2$  recovery facility. Cooling towers will be built at nuclear facilities to control thermal pollution. Much higher spending for research and development was reported, including a 10-year, \$10 million breeder reactor project in one utility company.

In the non-ferrous metals industry, capital investments in pollution control facilities have been high. One firm spent \$50 million at three copper smelters to bring them into compliance with federal air standards. Materials handling equipment for a new mine was designed and constructed by another firm for better waste management. Equipment was installed for air and water monitoring, for fly ash removal from stack gases, and for water purification in various companies. Research and development activities have also increased, including solid waste disposal research by an aluminum producer. Aluminum can recycling was also greatly expanded. In the future, efforts will be continued to find low-cost solutions for  $\text{SO}_2$  recovery, and more air and water purification equipment will be installed. Additional installations of a new mixed gas fluxing system will be made by an aluminum producer to reduce air pollution. Aluminum can recycling will be expanded. Research will be

continued, including ecological studies, and "the education and training of employees in the social and technical aspects of environmental protection" will receive special attention.

In the steel industry, the activities have been the same--large investments in air and water pollution control equipment. One company reported that \$250 million were spent or committed for pollution control in the past five years (through 1971). Another firm had spent \$75 million, including 30% of the capital budget in 1971, for pollution control. More of the same is planned for future years.

In the paper industry, the efforts have been focused on waste water treatment facilities and air pollution controls. This industry has a wide variety of pollution problems and much old equipment which cannot be modified easily to reduce pollution levels. Some older plants have been shut down because the costs to control pollution could not be justified. Lagoons were expanded and aerators were installed for waste water treatment and Venturi scrubbers and electrostatic precipitators were installed for air pollution reduction. Secondary water treatment facilities, more mechanical aerators, evaporators, 100% black liquor oxidation systems, more electrostatic precipitators, and other plant modifications are planned for the near future.

In summary, companies in all seven industries which were studied have spent large sums on pollution abatement equipment in the last five years and will continue to do so for the next several years. Efforts to control pollutants in motor vehicles is of primary concern in the automobile industry, and the outcome of this effort will affect the fuels produced and

sold by petroleum companies. Research and development on environmental protection problems is a major activity in all of these industries, and most companies have expanded or added staff departments to handle pollution control activities.

State vs. Federal Pollution Control (Questions #15 and #16)

In answer to the questions about the advantages of pollution control, in the sense of surveillance and guidance, by state and by federal agencies, the pattern of responses was very similar between respondents. Most felt that state agencies were closer to the immediate problems in industrial firms and were therefore more sensitive and more responsive to local needs. They were considered to be more knowledgeable, especially about local problems and needs. Some said they were less costly, had better staffs, made faster decisions, and were already established with on-going programs. The advantages of state vs. lower level (county or city) control agencies were viewed by one respondent as (1) keeping rule-setting away from petty local politicians and (2) being able to afford a more qualified staff. One criticism of state agencies was "the tendency to blindly follow federal recommendations." Another respondent felt that state agencies sometimes "exploited public impatience for political advantage, resulting in extreme overkill."

The most frequently mentioned advantage of federal control was the application of uniform rules and regulations nationwide so that all were treated the same and "competitive equality" resulted. Federal units were considered to be better insulated from local political pressure, more



objective, and in a position to prevent "pollution havens." They were also considered desirable to back up weak state control efforts and to provide centralized research. One respondent felt they had "sufficient funding to relate regulations to the data base," and another cited better enforcement as an advantage of federal agencies. If federal control (alone) existed, "a diverse corporation wouldn't have to keep up with so many different standards and procedures," and competing agencies would be avoided. Others said that federal agencies can sometimes handle very large or interstate problems better (like auto emissions), and that regulations may be more appropriate for densely populated areas where contiguous states are involved. A closely related advantage was the ability "to provide coordinated planning effort for the entire nation in all aspects of pollution."

A criticism of federal control was that "the inflexibility and red tape make it almost unworkable." The same respondent also considered federal control to be "very political, particularly in a year of Presidential elections." A utility company president felt that a federal agency had no advantages and said that (existing ones) were "a large bureaucracy whose personnel had little competence in this complex technology and were issuing unrealistic regulations without regard for technical or economic feasibility." Another company president cited high personnel turnover as a disadvantage of federal agencies. He said the regional office of the Environmental Protection Agency in Atlanta had a complete turnover of personnel in a relatively short period of time. The shifting responsibility for pollution control among federal agencies was

also considered a serious problem; since 1965, three agencies--the Department of Health, Education, and Welfare, the Department of Interior, and the Environmental Protection Agency--have been responsible for pollution control. Several respondents also stated that the uniform regulations imposed by federal agencies was not always desirable--that local factors such as water flow rate and oxygen content should be considered when setting standards.

A few respondents favored federal control over state control, but a few others were strongly opposed to federal control and the application of single laws on a nationwide basis. However, the sentiment of many respondents was stated concisely by one vice president who said "either way is probably all right; both at the same time is impossible." Industrial managers must try to satisfy pollution control agencies at the local, state, and federal levels and must deal with many different local and state agencies with different requirements when plants are located in many places. Therefore, the greatest need at the beginning of 1973 is for a clearer separation of the duties of pollution control agencies at different levels and a dovetailing of their efforts so that overlapping and inconsistent control measures are avoided. This should lead to more efficient (less expensive) control programs, more effective pollution abatement, and a great reduction in the frustration level of all concerned.

#### Corporation Planning Systems (Questions #17 and #18)

The responses to questions on company planning systems were very meager. This was apparently due to (1) the fact that the questions were long and complex and (2) the fact that the persons who were knowledgeable

about pollution control activities were not involved in broader corporate planning activities. However, several companies reported that their planning systems were highly formalized, following the trend of the past decade. A separate study on formal planning systems is planned for 1973.

#### SUMMARY AND CONCLUSIONS

Fifty-three privately-owned industrial corporations and one government-owned corporation provided information which is included in this report on the impacts of the environmental protection movement in the United States on corporate plans and actions. Most of these companies were very large firms and most were in the automobile, petroleum, chemical, paper, non-ferrous metals, steel, and electric utility industries.

Approximately 80% of the respondents had established a formal policy on "environmental protection" and in most cases, the policies were formalized in the years from 1967 to 1971. Environmental protection efforts, in addition to satisfying new, stricter legal requirements of the past few years, were viewed by many companies as an extension of the growing emphasis on corporate "social responsibility."

The major impact of the pollution control movement on the corporations studied had been a required investment of millions of dollars in new equipment and facility modifications to reduce the emission rate of air and water pollutants from effluents which were by-products of industrial production activities. The average capital expenditure per firm for the companies which provided cost data (using some estimates to convert data

to a common basis) was \$14.8 million in 1971 and an estimated \$21.9 million in 1972. This level of spending accounted for about 10 to 15 percent of the capital budgets in these companies, with a range of 5 to 30 percent reported. Some plant shut downs were reported, as well as additions and deletions to product lines, which resulted from the pollution control movement. A large increase in research and development spending was reported, as well as the formation of many new staff departments and some executive positions to coordinate the pollution control efforts in each company. A major effort in the automobile industry was to redesign engines or provide some method to reduce the pollution emission rate in motor vehicle exhaust gas. A related effort in the petroleum industry was to provide low-lead or lead-free gasolines for the same purpose.

The profitability of many firms had been reduced in recent years as a result of pollution control expenditures and the resulting higher product costs. Apparently very few price increases had been made, due to competitive pressures, except in the government-regulated utility industry. Some firms reported that the survival of the company was at stake as pollution standards became more strict. There was great concern and almost unanimous opposition to the Muskie Bill (S.2770) and to similar bills in the U.S. House of Representatives. Air and water pollutants were of primary concern to the companies studied, but several were also involved in reducing thermal, noise, solid waste, and radioactive pollution. Planning criteria had been changed in all of the companies to consider very carefully the impact on the environment of any proposed new business venture or capital investment.

The comments of respondents reflected the belief that many conservationists, legislators, and concerned citizens have a serious lack of knowledge and perspective about the many impacts and considerations in controlling environmental pollutants in industrial operations. The time required to plan and implement changes in production systems is greater than generally assumed, the complexities of changing processes and products are underestimated, and the economic reverberations are often much more serious than believed. The fact that some industrial managers have to be prodded to reduce pollution levels and to report accurately the status of pollution problems and solutions causes the public to be suspicious of all industrialists who protest the severity of new standards, the high costs of equipment, and the imposed time schedules for pollution reduction. They say that managers are yelling "wolf" merely to protect their vested interests, to keep profits high, and to preserve the status quo.

On the other hand, industrial managers may not understand the full impact or the potential danger to living plants and animals from the combined effects of pollutants of many kinds from many sources. They are shocked over the sudden shift in values and priorities of society, and feel persecuted because they are viewed as the villains when they have merely tried to provide the goods and services demanded by society for many decades under conditions which were perfectly acceptable to all concerned. Some view the conservationists as uninformed do-gooders or narrow-minded fanatics. They consider many laws as politically motivated,

and they see federal and state control agencies as competing bureaucrats who are whipsawing the hapless industrial firms. They also see a citizenry which is quite ready to deride and blame producers of goods for the state of the environment without making any personal effort to reduce non-industrial pollutants or to bear much of the cost of pollution control through higher product prices or taxes. They are concerned that we have not really determined the harm from various levels of "pollutants," yet we impose stricter and stricter control standards for air and water effluents, even before equipment can be installed to meet the first standards.

Thus, there is a "knowledge gap" on both sides of the issue and there is a serious "communication gap" between those on each side. Instead of adopting an aloof, know-all, distrusting attitude toward those with different primary interests, concerned persons on each side of the issue should be willing to listen to their protagonists with an open mind and to discuss the critical factors candidly in order to gain in understanding and perspective, and not to judge or find a scapegoat.

With respect to the methods of providing government surveillance and guidance for the pollution control efforts of industrial firms, many advantages and disadvantages for federal control and for state control were given by the respondents, based on their current experience with each type of agency. The general feeling was that each had a unique role to fulfill, but that the present duplication and contradictory efforts should be eliminated by a better coordinated control system which involved local, state and federal agencies.

Finally, pollution control efforts of major proportions will continue in industrial firms for many years. The impacts on product choices, product prices, plant locations, resource allocations, and trade-offs between social goals will be great in future years. The cost of environmental protection to the average citizen through higher prices or higher taxes will be significant, even though a more healthful environment should result. Industrial managers will remain in the spotlight and their decisions will be crucial in protecting the environment and in meeting many other needs of society.

APPENDIX A

COVER LETTER MAILED WITH QUESTIONNAIRE

February 15, 1972

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Dear Mr. :

I am engaged in team research funded by a NASA grant on the social and economic impacts of environmental protection efforts. My individual aim is to determine the impacts on planning criteria and decisions in industrial corporations.

I have interviewed several corporation executives to learn of pollution concerns and planning impacts. However, my time and funds for travel are limited, so I am writing you, and the presidents of several other large companies in the chemical, paper, electric utility, petroleum, automobile, and primary metals industries, to request information about developments in each company on pollution control and to get top management views on various governmental control plans.

My feeling is that the real concerns and viewpoints of corporate managers have not been stated fully or in concert in public discussions or environmental protection, and I hope to fill this gap with the results of this study. I will also evaluate the results as objectively as I can to seek broad implications for corporations, governmental units, and society at large.

My interest in corporate planning systems has remained high since I completed a dissertation study on this subject in 1965 at The University of Michigan. My results were published by Prentice-Hall, Inc., in 1967 in a book entitled Long-Range Planning Practices in 45 Industrial Companies, and a Japanese edition was published in 1970.

The enclosed questionnaire is lengthy, but is designed for rapid completion. I hope very much that you or an associate with a top management perspective will be able to answer my questions and return the form to me soon.

Information you provide will be handled by me personally and will not be associated with your name or your company's name unless you grant express permission. I will appreciate your contribution to this study and believe it will be valuable.

Sincerely yours,

Harold W. Henry  
Associate Professor of  
Industrial Management

HWH:it

Enclosure

-67-



APPENDIX B

-68-

Please Return To: Dr. Harold W. Henry, Associate Professor  
College of Business Administration  
The University of Tennessee  
Knoxville, Tennessee 37916

CONFIDENTIAL

Responses will not be associated with a person or company without express permission.)

QUESTIONNAIRE ON POLLUTION CONTROL AND COMPANY PLANNING

- . First, does your company have a formal policy on "environmental protection"? Yes \_\_\_ No \_\_\_  
If Yes, could you enclose a copy? Yes, copy enclosed \_\_\_ Year policy established \_\_\_  
If No, does an implicit policy exist? Yes \_\_\_ No \_\_\_  
Please explain or summarize the views or philosophy of top management in your company  
(if not fully explained in a policy statement you can provide).
- . Next, does your company have a formal policy on "social responsibility" which is broader  
in scope than or different from the policy on environmental protection? Yes \_\_\_ No \_\_\_  
If Yes, could you enclose a copy? Yes, copy enclosed \_\_\_ Year policy established \_\_\_  
If No, does an implicit policy exist? Yes \_\_\_ No \_\_\_  
Please explain or summarize top management's views on "social responsibility" (if not  
fully explained in a policy statement you can provide).
- . What priority does your company assign to the broad, general business objectives below?  
Please enter 1, 2, 3, 4, etc., or indicate any equality in priority.
- |  |  |
|--|--|
| Provide needed goods or services _____                     | Fulfill social responsibilities _____                |
| Make reasonable profit return on<br>invested capital _____ | Grow in size _____                                   |
| Survive for an indefinite period _____                     | Create new or better products<br>through R & D _____ |
| Other _____  | Other _____  |
- . Has any significant shift in emphasis or importance between these objectives occurred  
in the past 3 years? (For example, less emphasis on profitability and more on social  
responsibility) Yes \_\_\_ No \_\_\_  
If Yes, please explain.
- . What types of pollution or environmental problems are concerns in your company? Please  
rank below as 1, 2, 3, etc., to indicate importance; enter 0 if not significant.
- |                       |                         |                                 |
|-----------------------|-------------------------|---------------------------------|
| Air Pollution _____   | Thermal Pollution _____ | Solid Waste Pollution _____     |
| Water Pollution _____ | Noise Pollution _____   | Radioactive Contamination _____ |

## APPENDIX B--Continued

6. What were the major impacts in your company during 1971 and the expected impacts in 1972 of the increasing public concern over environmental protection and the cumulative changes in laws, regulations or company policies. Please check the blank to the left of each applicable impact below and indicate the approximate dollar impact when appropriate. Add explanatory comments or illustrations under each line, if possible.

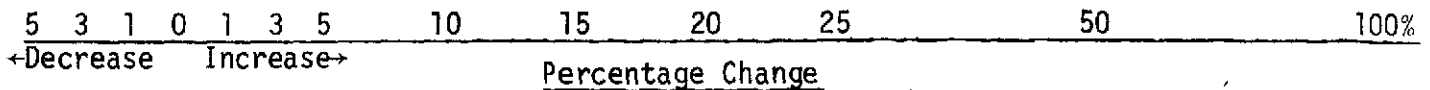
	Approximate Dollar Impact 1971	Projected 1972
<b>A. IMPACT ON FACILITIES:</b>		
___ Investment in new equipment (cost)		
___ Modifications--existing processes or facilities (cost)		
___ Shut down of selected operations (book value)		
___ Plant shut downs (book value)		
___ Relocation of facilities (cost)		
<b>B. IMPACT ON PRODUCTS, SERVICES OR ACTIVITIES:</b>		
___ Deletion of some products or services (sales decline)		
___ Increased sales of existing products or services (change)		
___ Addition of new products or services (sales increase)		
___ Modifications in product design or packaging		
___ Change in R & D efforts (\$'s, + or -)		
___ Acquisitions, mergers, or selloffs (\$'s, + or -)		
<b>C. IMPACT ON CORPORATION PERFORMANCE:</b>		
___ Change in profitability (increase or decrease)		
___ Change in return on owner's equity (up or down)		
<b>D. IMPACT ON MANAGEMENT SYSTEM:</b>		
___ Changes in planning criteria (other than meeting legal requirements). Please explain.		
___ Additions to the organization (new staff or operating units or positions). Please explain.		
___ Changes in top management philosophy and policies. Please explain.		
___ Other impacts. Please explain.		

## APPENDIX B--Continued

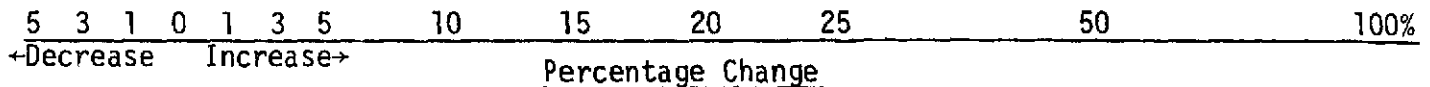
6. What were the major impacts in your company during 1971 and the expected impacts in 1972 of the increasing public concern over environmental protection and the cumulative changes in laws, regulations or company policies. Please check the blank to the left of each applicable impact below and indicate the approximate dollar impact when appropriate. Add explanatory comments or illustrations under each line, if possible.

	Approximate Dollar Impact 1971	Projected 1972
<b>A. IMPACT ON FACILITIES:</b>		
<input type="checkbox"/> Investment in new equipment (cost)		
<input type="checkbox"/> Modifications--existing processes or facilities (cost)		
<input type="checkbox"/> Shut down of selected operations (book value)		
<input type="checkbox"/> Plant shut downs (book value)		
<input type="checkbox"/> Relocation of facilities (cost)		
<b>B. IMPACT ON PRODUCTS, SERVICES OR ACTIVITIES:</b>		
<input type="checkbox"/> Deletion of some products or services (sales decline)		
<input type="checkbox"/> Increased sales of existing products or services (change)		
<input type="checkbox"/> Addition of new products or services (sales increase)		
<input type="checkbox"/> Modifications in product design or packaging		
<input type="checkbox"/> Change in R & D efforts (\$'s, + or -)		
<input type="checkbox"/> Acquisitions, mergers, or selloffs (\$'s, + or -)		
<b>C. IMPACT ON CORPORATION PERFORMANCE:</b>		
<input type="checkbox"/> Change in profitability (increase or decrease)		
<input type="checkbox"/> Change in return on owner's equity (up or down)		
<b>D. IMPACT ON MANAGEMENT SYSTEM:</b>		
<input type="checkbox"/> Changes in planning criteria (other than meeting legal requirements). Please explain.		
<input type="checkbox"/> Additions to the organization (new staff or operating units or positions). Please explain.		
<input type="checkbox"/> Changes in top management philosophy and policies. Please explain.		
<input type="checkbox"/> Other impacts. Please explain.		

7. What was the impact of pollution control activities in your company during 1971 on the average production costs per unit of product (excluding deleted products)? Please draw a vertical line on the cost change scale below to indicate your best estimate.

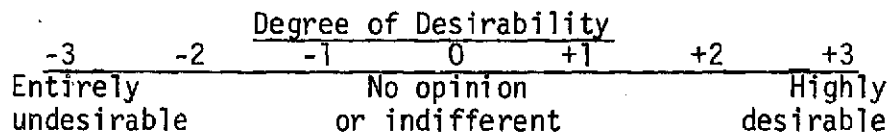


8. What was the impact of pollution control actions in your company during 1971 on the average price you charged per unit of product? Please draw a vertical line on the price change scale below to indicate your best estimate.

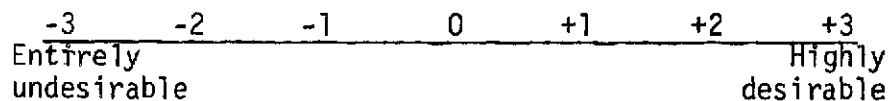


9. What are your views on the following proposed or existing plans for pollution control by governmental agencies. Circle one number on the preference scale for each plan, (a) through (f). Add comments on the right side of each plan.

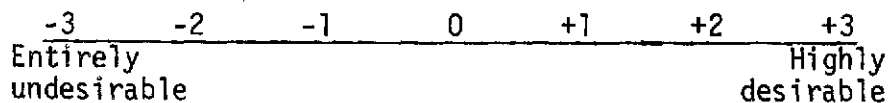
(a) A tax scaled to the amount or level of pollution.



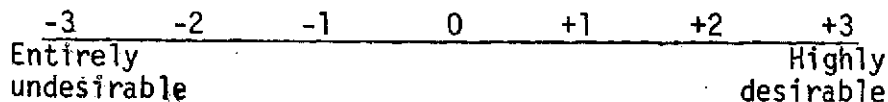
(b) User fees for waste treatment in regional or municipal facilities.



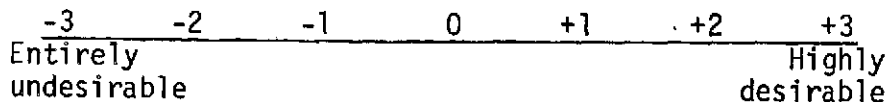
(c) Fines for non-compliance with regulations.



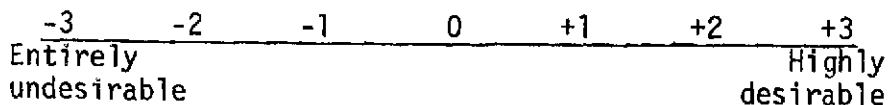
(d) Periodic sampling or monitoring of effluents and shut down authority.



(e) Issuance of mandatory effluent discharge permits.



(f) State financing, purchase, and lease-sale of pollution control equipment.



(g) Other control plans your company would prefer. \_\_\_\_\_

10. What is your company's view of U. S. Senate bill S.2770 which establishes a goal (rather than a legal requirement) of zero water pollution by 1985?

# APPENDIX B--Continued

11. If the government should provide positive incentives for pollution control efforts, what plan would you favor? Circle one number on the preference scale for each proposal, (a) through (d). Please state any special conditions or limitations you consider desirable.

(a) Accelerated depreciation on pollution control equipment

Degree of Desirability						
-3	-2	-1	0	+1	+2	+3
Entirely undesirable			No opinion or indifferent			Highly desirable

(b) Income tax credit for investment in pollution control equipment.

-3	-2	-1	0	+1	+2	+3
Entirely undesirable						Highly desirable

(c) Cash rebates for purchase of pollution control equipment.

-3	-2	-1	0	+1	+2	+3
Entirely undesirable						Highly desirable

(d) Government-paid consultants to assist companies with pollution problems.

-3	-2	-1	0	+1	+2	+3
Entirely undesirable						Highly desirable

(e) Other incentives your company would prefer. \_\_\_\_\_

12. What are your major concerns about the future which relate to environmental protection? Please check each appropriate item below and add comments.

\_\_\_ Pending legislation

\_\_\_ Unrealistic (extremely restrictive) pollution control standards

\_\_\_ Continually shifting pollution standards

\_\_\_ Unequal or incomplete enforcement of pollution control laws (unfairness between companies)

\_\_\_ Low profitability

\_\_\_ Survival of the company

\_\_\_ Required facility relocations

\_\_\_ Dislocation or reductions in personnel

\_\_\_ Major investment in new equipment or facilities

\_\_\_ Major changes in product design

\_\_\_ Major changes in product lines or services

\_\_\_ Other concerns. (Please state)

13. Please summarize the major pollution control actions taken in your company in the past three years (1969, 1970, 1971)?
14. What pollution control actions are planned for 1972 and future years?
15. What are the advantages of pollution control by state agencies?
16. What are the advantages of pollution control by federal agencies?

17. What is your planning system like?

Could you send reference material (a planning guide, policy and procedure statements, an article or brief narrative on a separate sheet) to indicate how decisions are made about corporate or divisional objectives, strategies and action plans.

The following aspects of planning are of particular interest:

- (1) The organization or responsibility assignments for overall planning and for various segments of planning.
  - (2) The procedures for initiation, review, integration and approval of plans.
  - (3) The schedule of planning activities.
  - (4) The scope of planning efforts (various functional or specialized areas).
  - (5) Administrative problems or performance inadequacies due to the way you plan.
  - (6) Recent modifications in your planning system--in organization, degree of formality, procedures, schedules, inputs or decision-making criterion.
  - (7) Special planning techniques which you utilize (for forecasting, evaluating alternatives, optimizing, allocating resources, etc.).
18. How would you classify your planning system in terms of the degree of formality? Please draw a vertical line on the scale below to indicate your estimate.

0 100  
 Very informal Very formal

19. Can policy statement you provide be quoted as policies of your company? Yes \_\_\_ No \_\_\_  
 If you have included previously published or quotable comments, please note.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Industrial Classification of Your Company  
 Name of Person Completing Form (optional)  
 Position of Person Completing Form  
 Date Completed.

## APPENDIX C

## COMPANIES WHICH PROVIDED INFORMATION OR VIEWPOINTS

Automobile Industry

Chrysler Corporation  
 Ford Motor Company  
 General Motors Corporation

Chemical Industry

Allied Chemical Corporation  
 American Cyanamid Company  
 Celanese Company  
 Dow Chemical Company  
 Ethyl Corporation  
 W. R. Grace and Company  
 Hercules, Inc.  
 Monsanto Company  
 Olin Chemicals  
 Stauffer Chemical Company  
 Tennessee Eastman Corporation  
 Union Carbide Corporation

Electric Utility Industry

Consolidated Edison Company of  
 New York  
 Detroit Edison Company  
 Duke Power Company  
 Florida Power and Light Company  
 Pacific Gas and Electric Company  
 Philadelphia Electric Company  
 Virginia Electric Power Company  
 \_\_\_\_\_ (Electric and Gas) Company

Non-Ferrous Metals Industry

American Metal Climax, Inc.  
 American Smelting and Refining  
 Company  
 Howmet Corporation  
 Koppers Company, Inc.  
 Reynolds Metals Company

Paper Industry

Crown Zellerbach  
 International Paper Company  
 The Mead Corporation  
 Tennessee River Pulp and Paper  
 Company  
 \_\_\_\_\_ (Forest Products) Company

Petroleum Industry

Ashland Oil, Inc.  
 Continental Oil Company  
 Gulf Oil Company  
 Marathon Oil Company  
 Mobil Oil Corporation  
 Phillips Petroleum Company  
 Shell Oil Company  
 Standard Oil Company of  
 California  
 Standard Oil Company (New  
 Jersey)  
 Sun Oil Company  
 Texaco, Inc.

Steel Industry

Armco Steel Corporation  
 Jones and Laughlin Steel  
 Corporation  
 U. S. Steel Corporation  
 \_\_\_\_\_ Steel Company  
 \_\_\_\_\_ Steel Company

Other Industries

General Electric Company  
 Eastover Mining Company  
 Tenneco, Inc.  
 Tennessee Valley Authority  
 The Babcock and Wilcox Company

## APPENDIX D

## COMPANY POSITIONS OF RESPONDENTS

Top Executives and Staff Assistants

Chairman  
President--3  
Executive Vice President  
Executive Vice President, Manufacturing  
Senior Vice President--2  
Vice President--2  
Vice President, Research and Chemicals  
Vice President--Manufacturing and Technology  
Vice President, Corporate Growth Planning  
Administrative Assistant to Vice President and Chief Engineer  
Administrative Assistant to Vice President, Environmental Control--Safety  
Assistant to Vice President, Coordination and Planning  
Manager--Corporate Development

Environmental Protection Specialists (including Staff Officers)

Vice President, Environmental Protection  
Vice President, Environmental Control  
Executive Director, Environmental Control  
Director, Environmental Affairs  
Director of Environmental Affairs  
Director, Environmental Control  
Director, Environmental Protection  
Director, Environmental Quality  
Director of Environmental Control Systems  
Manager, Environmental Affairs  
Manager, Environmental Resources  
General Manager, Environmental Services  
Corporate Coordinator, Pollution Control  
Corporate Coordinator--Environmental Improvement  
Coordinator of Air and Water Conservation  
Director, Automotive Emissions Office  
Director of Environmental Research and Development  
Staff Engineer, Environmental Conservation Department  
Administration, Environmental Activities Staff  
Environmental Planning and Protection Committee Staff Member

Public Relations and Staff Specialists (including Staff Officers)

Vice President of Public Relations and Communications Division  
Vice President for Educational Affairs



## APPENDIX D-Continued

Assistant Vice President, Corporate Relations  
Director, Public Relations Planning and Research  
Director, Community Relations  
Director of Financial Relations  
Counsel, Special Legal Assignments  
Coordinator of Public Affairs  
Public Information Officer  
Manager, External and Special Reporting  
Supervisor--Educational Services  
Public Affairs Department, Environmental Affairs  
Public Relations Department Representative

## APPENDIX E

## CORPORATE POLICY ON ENVIRONMENTAL CONSERVATION

## IN SHELL OIL COMPANY

Shell Oil Company and its subsidiaries, as responsible members of society, share a nationwide concern for protection of this country's air, water, and soil. With this in mind, our company's policy is--

to treat with appropriate concern all materials and operations which contribute to pollution.

to comply with all regulations affecting water or air emissions, solid wastes, or light and sound intensities established by legislation for improving the environment.

to provide such additional protection of the environment as is feasible and practical.

to encourage, support, and conduct research for the purposes of achieving realistic environmental standards and to improve methods of environmental control.

to make available to others new conservation methods or techniques we may develop, which will contribute to better control of the environment.

to cooperate with government, industry, and associations on the establishment of pollution criteria and standards which relate either to our own operations or the use of our products.

to support and encourage programs aimed at street and highway cleanup and to conduct programs for the renewal and beautification of our service station and plant sites.

to keep employees, regulatory authorities, and the public informed about our activities in the conservation area.

to anticipate future environmental requirements and to provide for them in long-range planning.

Accordingly, we will strive for the best environmental conditions in all of our operations and shall consider the protection of air, water and soil, and the control of light and noise as a normal part of our business.

## APPENDIX F

## PETROLEUM COMPANY POLICY ON ENVIRONMENTAL AFFAIRS

General Policy

In many areas the public interest requires multiple and compatible use of air, water and land resources for agricultural, commercial, industrial, recreational, residential, resource development, transportation, and other beneficial purposes. In recreational and wilderness areas, preservation of the natural environment including fish, wildlife, forests, and plant life is of utmost importance.

In all such areas the use of air, water, and land resources, changed in quality to some degree by any beneficial use, should be under conditions that will protect health, prevent adverse and unreasonable effects on other beneficial uses in surrounding areas, and meet the requirement of applicable control regulations.

The company will support and practice positive and balanced conservation of all resources in the public interest.

Objectives

Specifically, the company in its exploration, producing, refining, transportation, marketing, research, and other activities will support and practice positive conservation measures by:

- taking precautions reasonably necessary to provide environmental protection of the surroundings in all areas where the company operates.
- maintaining and upgrading the appearance of company facilities and land so they will be in reasonable harmony with their surroundings.
- regulating the discharge of substances and noise from company facilities to comply fully with applicable control regulations.
- developing and marketing products that will assist in the solution of environmental quality problems.
- making intelligent, efficient and proper use of air, water, and land required to operate company facilities.
- designing, operating, and maintaining all of its facilities, including tankers, terminals, and off-shore installations to minimize the risk of, and prevent, discharge of oil to public waters and land.

## APPENDIX F-Continued

- keeping informed on environmental quality problems and their control, and conducting and supporting research to assist in their scientific solution.
- maintaining liaison with and assisting governmental, public, and industry groups seeking sound solutions to environmental quality problems.

## APPENDIX G

## DOW CHEMICAL COMPANY POLICY ON ENVIRONMENTAL IMPROVEMENT

Dow is committed to excellence and leadership in environmental improvement. We believe in and are working toward:

Federal standards for environmental quality.

Firm and uniform enforcement of these standards on a state and regional basis.

Compliance by Dow with these standards and the setting of even tougher goals for ourselves.

Candor regarding our problems, as well as our accomplishments.

We will implement this policy through:

Intensified environmental research as related to our wastes and products and to problems in the public domain.

Making environmental considerations an integral part of our decision-making processes.

Recycling and salvaging of materials to reduce wastes and conserve resources.

Continuing emphasis on--

- environmental health for our own employees, our neighbors and customers
- individual employee responsibility for and involvement in waste prevention.

## APPENDIX H

## POLICY ON ENVIRONMENTAL PROTECTION IN

## AMERICAN METAL CLIMAX, INC.

AMAX evaluates natural resource development plans with full consideration of their impact on the environment that has created these resources. There is no fundamental incompatibility between man's economic progress and the quality of life.

AMAX management believes that the mineral wealth of this earth can be utilized for human progress in complete harmony with conservation and recreation. Protection of the environment and recycling of waste materials is implicit in the proper utilization of the world's natural resources.

Dedicated to sound environmental planning, AMAX is vigorously attacking its own problems and making environmental considerations an integral part of the decision making process.

We recognize a responsibility to assist in the development and implementation of appropriate environmental regulations at all levels of government.

In the absence of defined guidelines, AMAX will govern its actions in keeping with the highest standards of responsible conduct.

## APPENDIX I

## OUTLINE OF POLICY ON SOCIAL RESPONSIBILITY--STANDARD OIL COMPANY

(NEW JERSEY\*)

The following guidelines are proposed for organizing concrete actions to bear out a philosophy of conduct which is both in the public interest and in furtherance of the Company's long-range economic performance.

1. Rigorously obey the letter and spirit of all applicable laws and regulations while working to modify those deemed unreasonable.
2. Aim for progressively higher levels of ethical conduct, in action and in communication.
3. Apply the test of relevance. Emphasize what we are uniquely placed to do: responsibly execute our own basic business. With respect to opportunities for responsiveness which do arise further afield, stress those to which Jersey resources and experience can make a particular contribution or with which the Company has some logical connection.
4. Be sensitive to the qualitative concerns of people, as expressed in their wishes for a cleaner and more esthetic environment and in their desires for fair treatment as consumers.
5. Acknowledge the relevance of government action.
6. Consider possibilities for cooperation with other companies.
7. Identify instances in which the Company interest and the public interest coincide.
8. Be open and objective in dealing.

\* Copied from The Roper Report, October, 1971.

## APPENDIX J

CHARTER FOR THE  
ENVIRONMENTAL CONSERVATION DEPARTMENT  
OF THE SHELL COMPANIES

This Department serves as the point of central coordination on all matters concerning environmental conservation for Shell Oil Company, its operating divisions, subsidiaries and affiliates. The Department is concerned with pollution problems that originate from the use of Shell products and from the operation of Shell plants and facilities.

The Environmental Conservation Department is mainly concerned with the development of Shell policies and position on environmental protection matters, with representation of Shell at governmental, industry, and other meetings or hearings, and with the collection, evaluation, and dissemination of pertinent information.

## Assigned Tasks

1. Develop and recommend company policy with respect to environmental conservation.
2. Implement approved policies and maintain coordination throughout the company.
3. Keep abreast of technical and legal developments, and legislative trends in the field of environmental protection. Evaluate this information and advise appropriate managerial personnel of the probable long and short-term effects, together with recommended courses of action.
4. Consult and maintain liaison with all departments of the company to insure effective coordination of environmental conservation activities, both on a national and local level. Liaison is maintained with associated companies of the Shell Group concerning developments that may have international significance.
5. Participate on industry committees at the policy-making level and coordinate membership of company personnel on society and local industry committees or groups.
6. Participate in pollution hearings of federal, state, and local bodies as Shell's representative or coordinate arrangements for appearance of other Shell personnel.
7. Review conservation problems brought up by various company departments and assist in the development of recommended courses of action.